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(58) Field of Search

UK CL (Edition N) H4K KOC KOF

INT CL⁶ H04M 1/57 11/00 11/02

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(54) Domestic monitoring and control system via a communication link

(57) A domestic monitoring and control system is disclosed which permits integrated remote control of domestic devices. A base unit controls devices such as light switches 54, power supply controllers 48 etc. and also serves as a telephone PABX and voice mail system. The system is operative to respond to commands entered on a telephone keypad either directly connected locally or remotely over a telephone line. These commands can serve to change the state of a device or to reproduce a message informing the status of a device, eg. using voice synthesis.

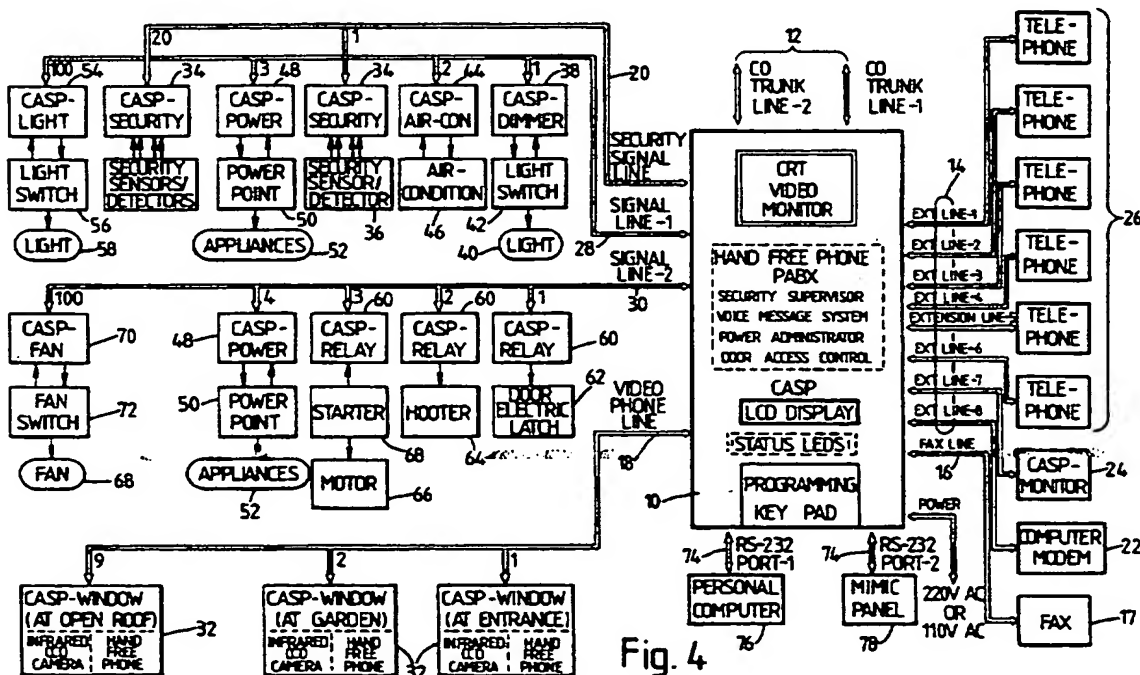
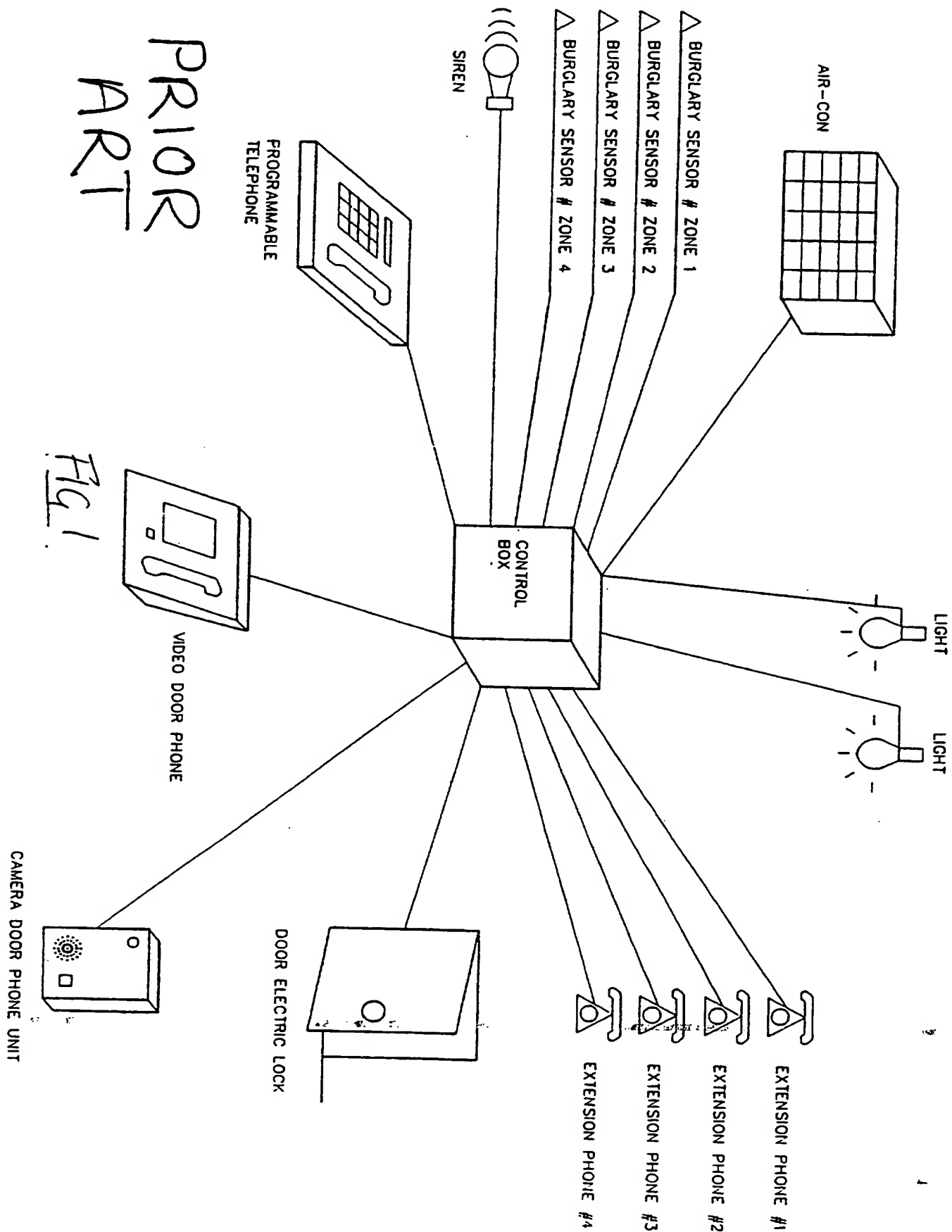


Fig. 4

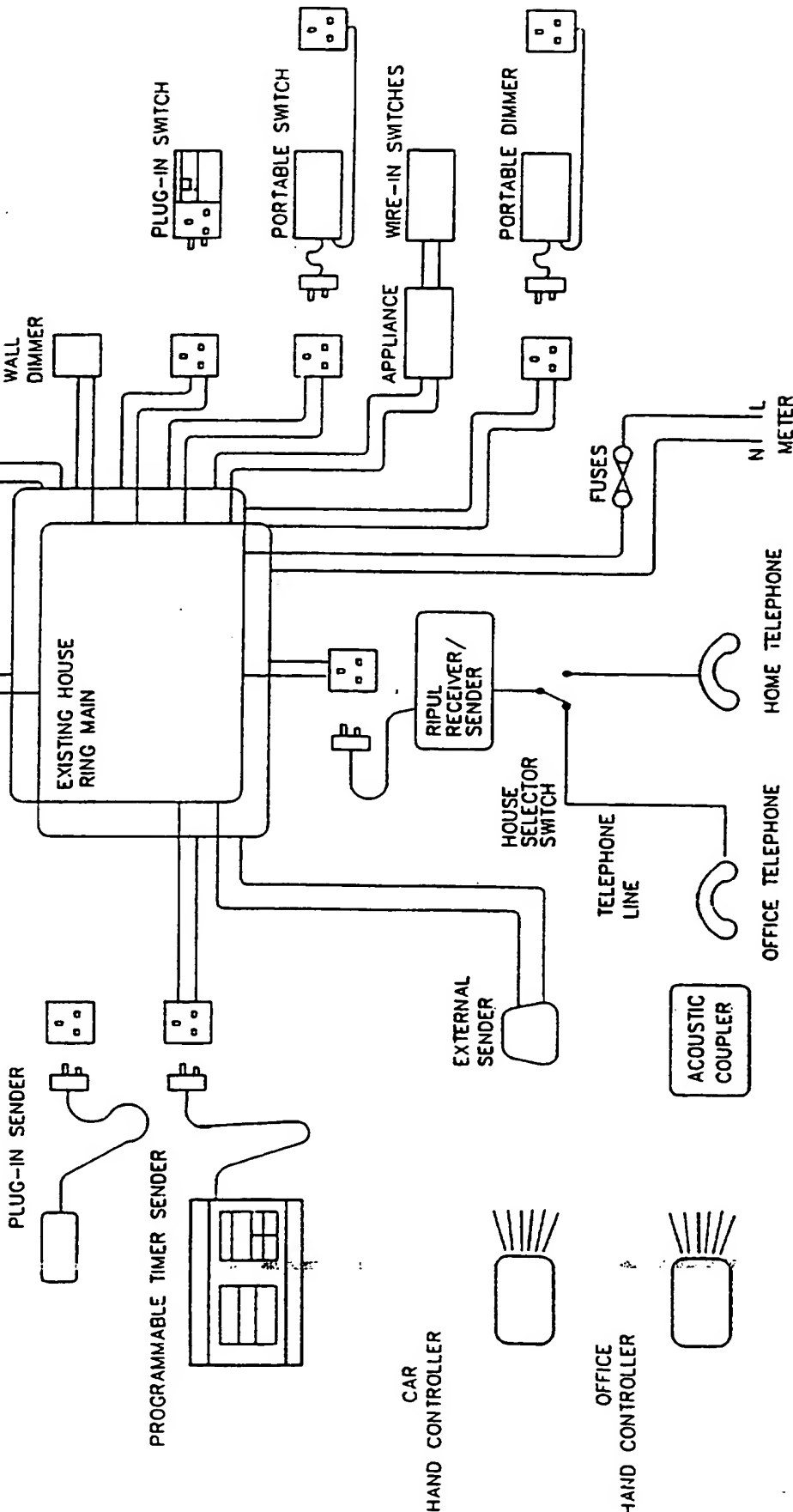
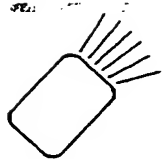
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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PRIOR
ART



SENDING THE SIGNALS
IN THE HOUSE
HAND-HELD CONTROLLER



PRIOR ART

Fig 2

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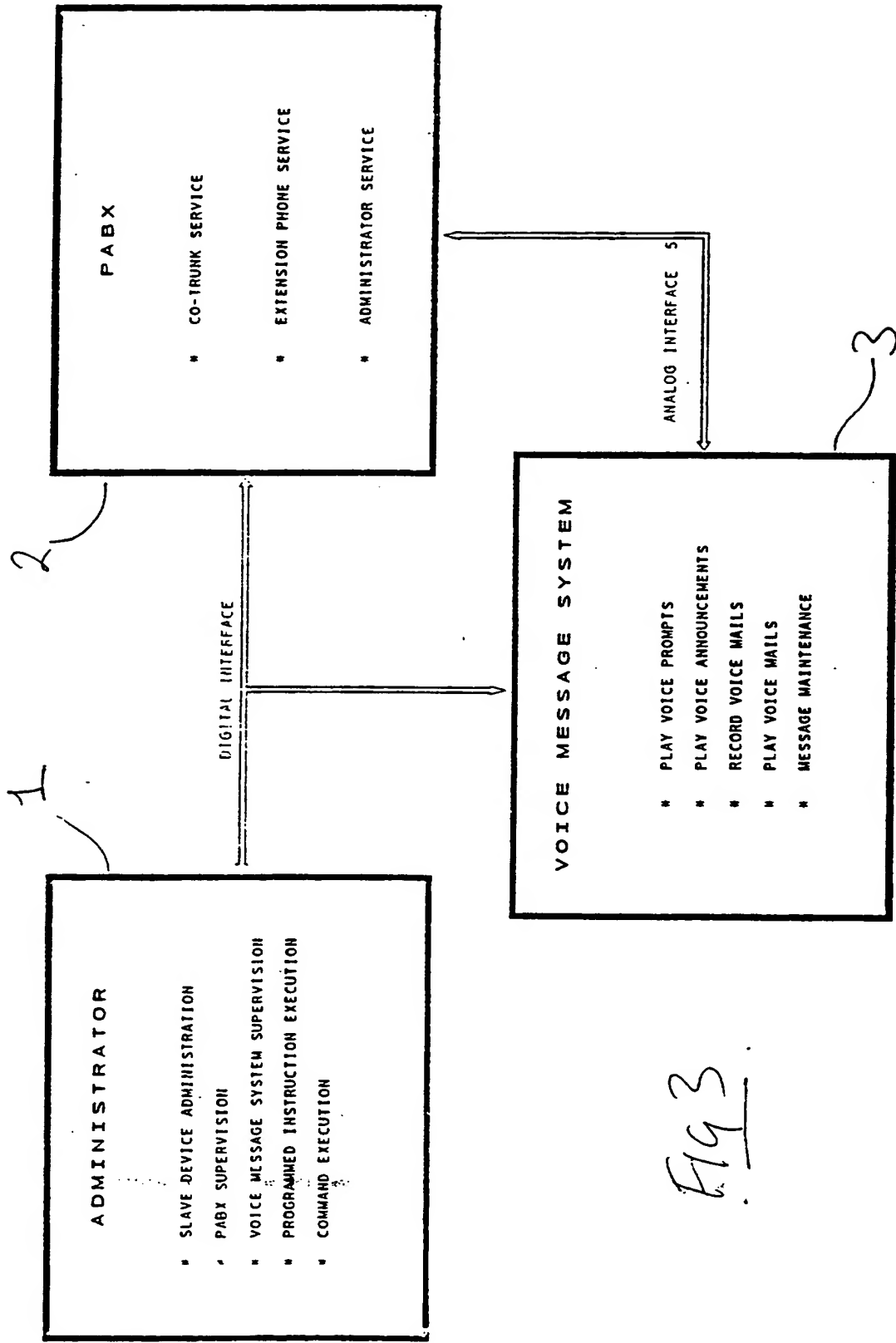


Fig 3

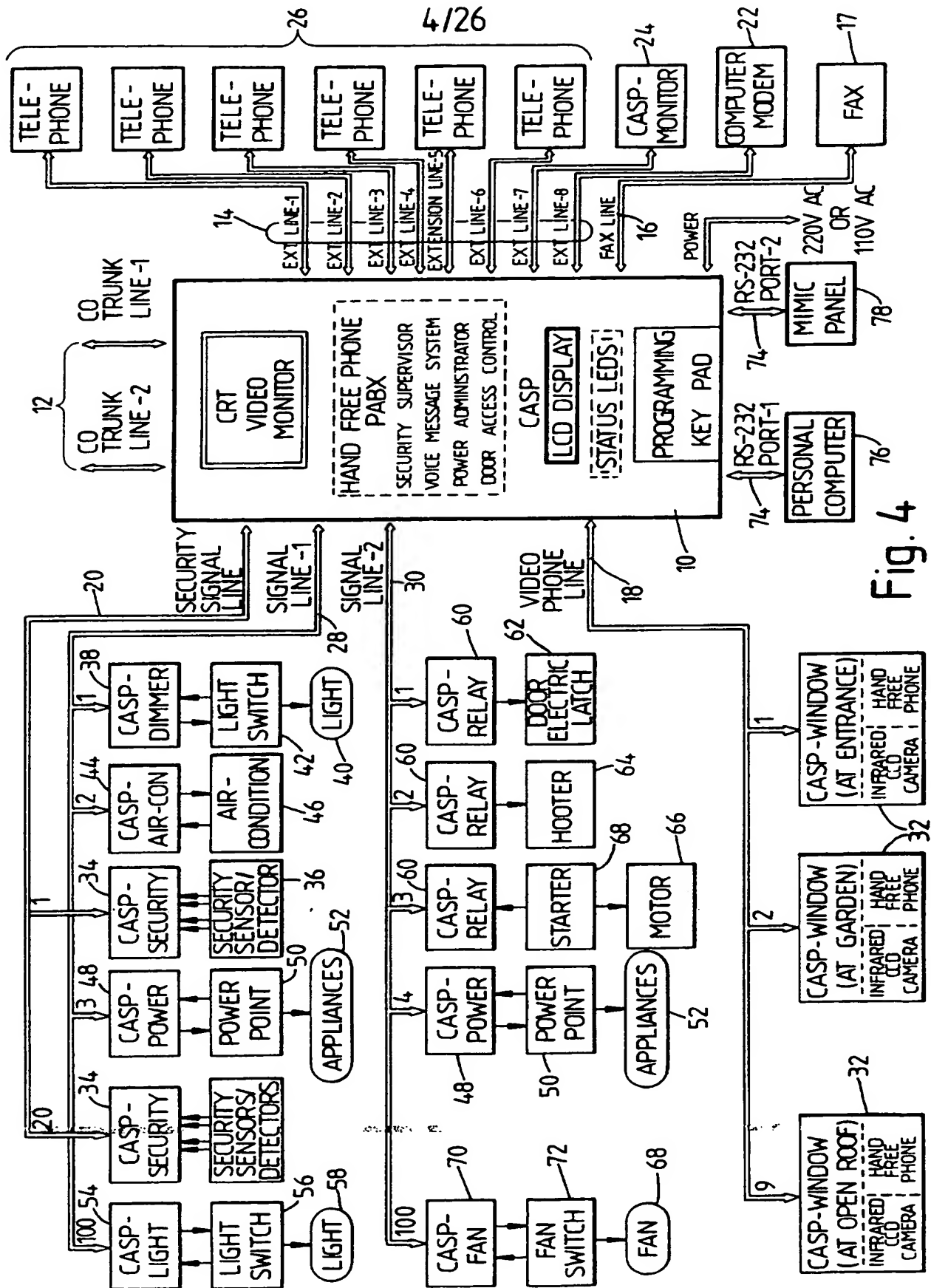
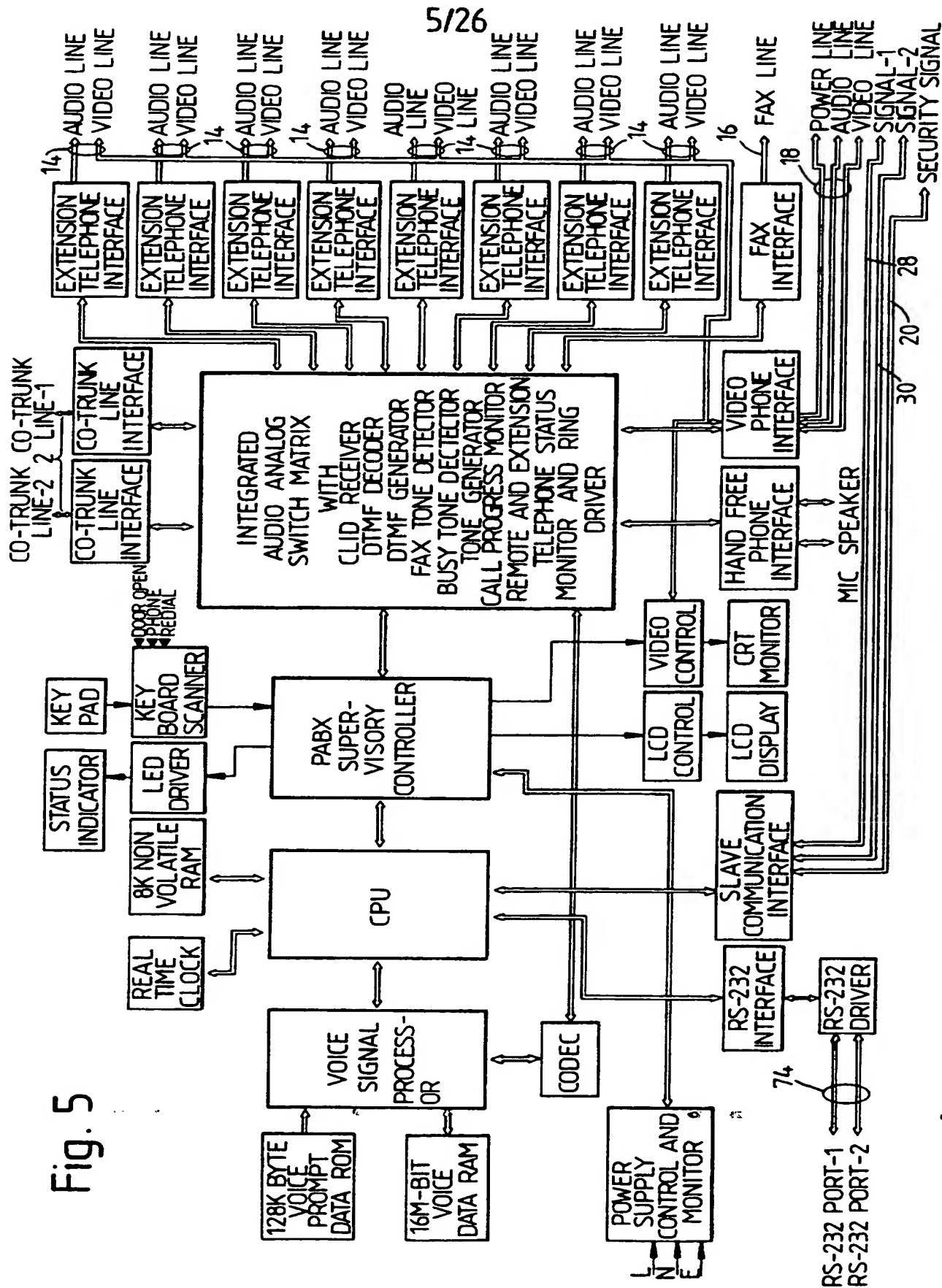


Fig. 4

Fig. 5



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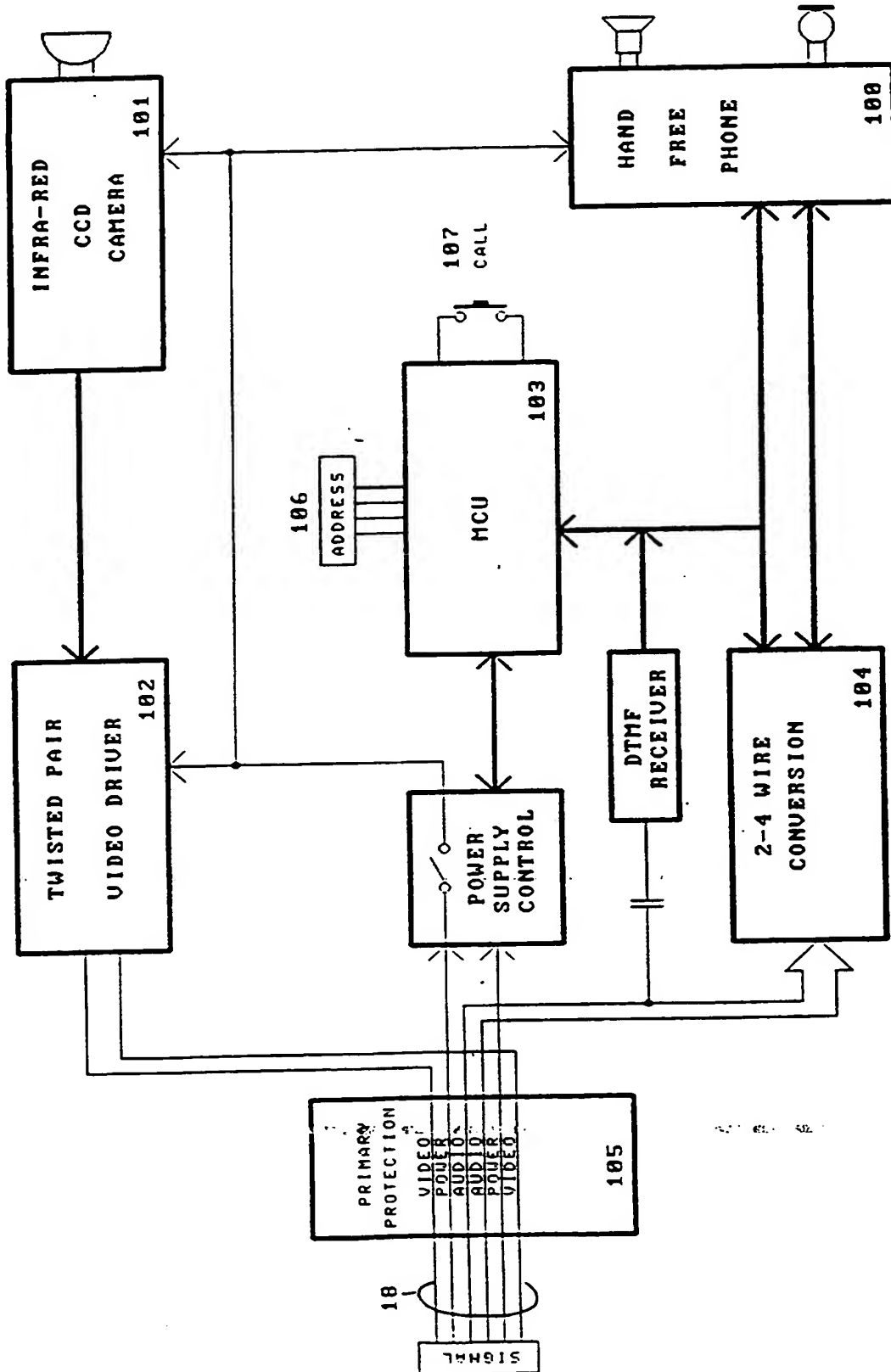


FIG. 6.

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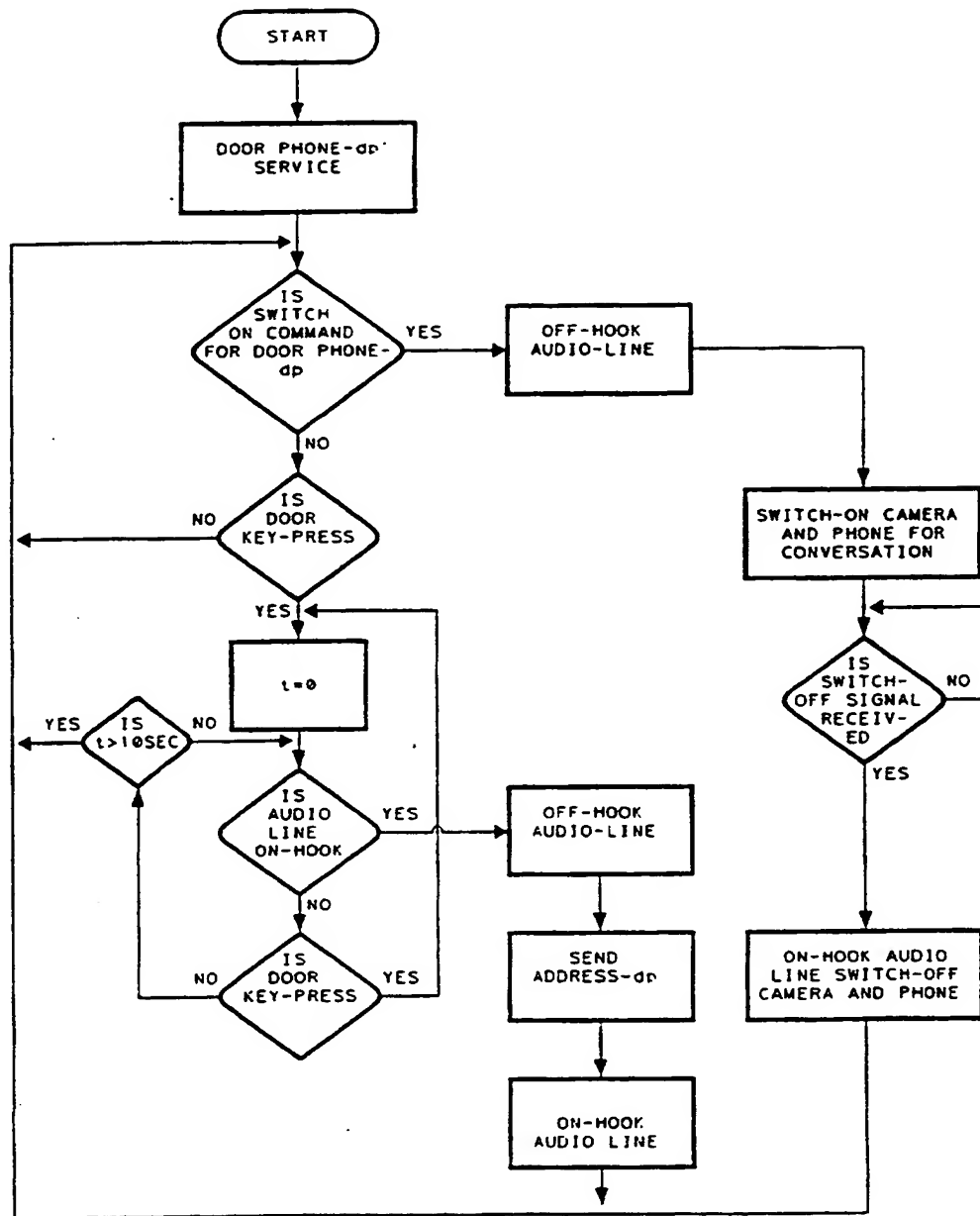


FIG 7

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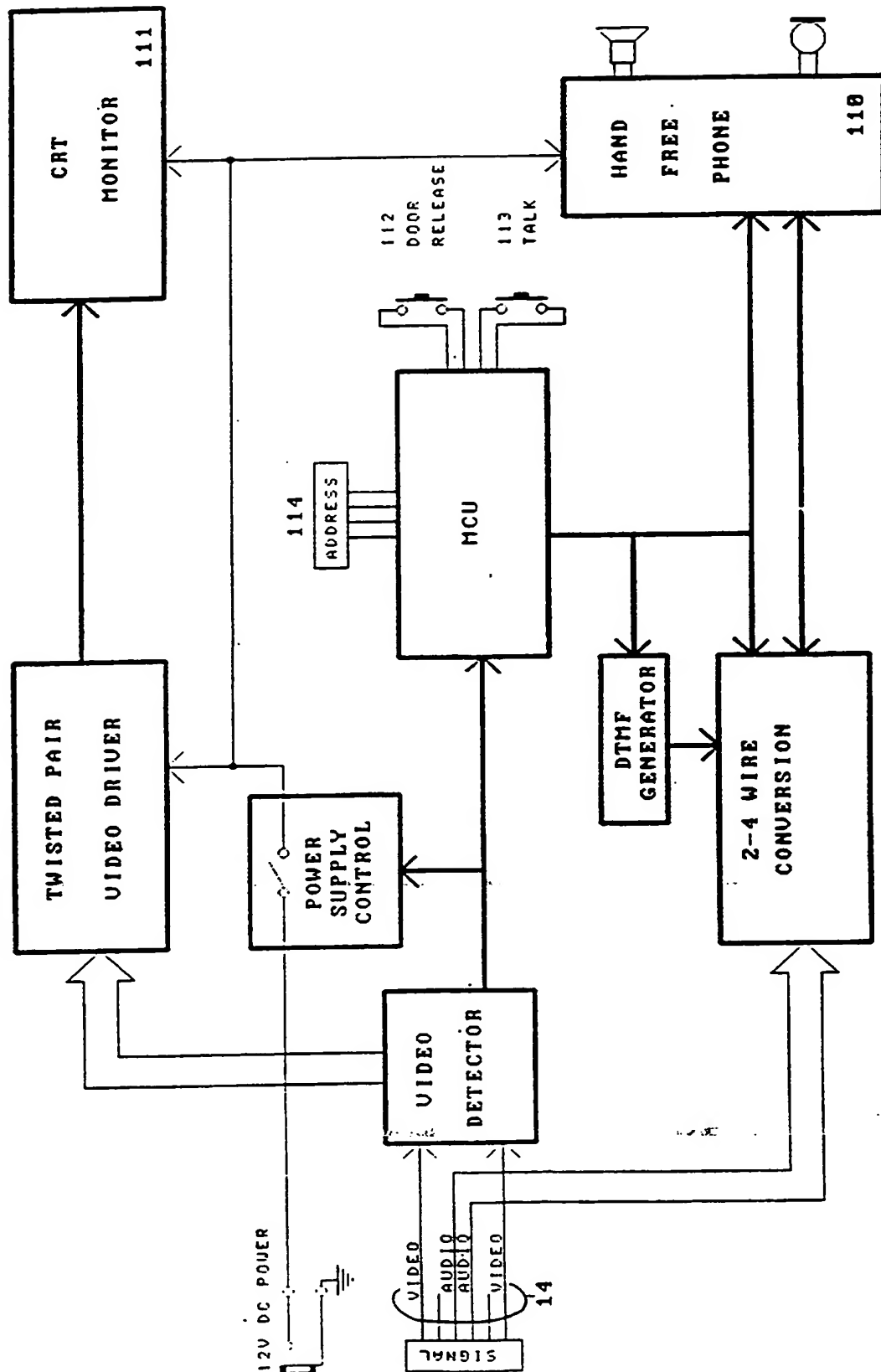


FIG. 8

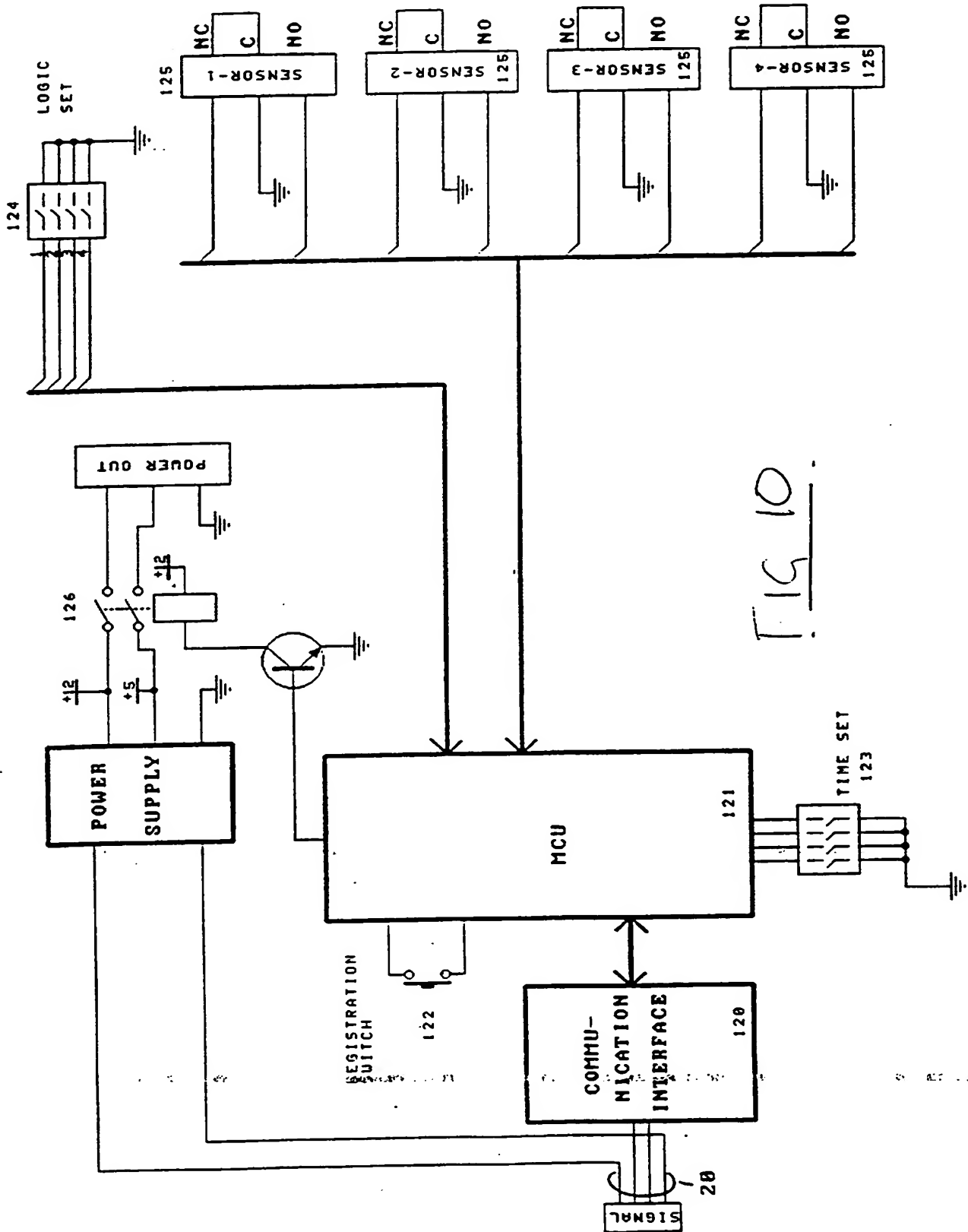
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graph TD
    START([START]) --> MONITOR[MONITOR PHONE SERVICE]
    MONITOR --> J1(( ))
    J1 --> D1{IS RING.  
FROM  
AUDIO LINE}
    D1 -- YES --> D2{IS TALK  
KEY PRESS}
    D1 -- NO --> D3{IS TALK  
KEY PRESS}
    D2 -- YES --> D4{IS DOOR  
PHONE CALL}
    D2 -- NO --> D3
    D4 -- YES --> P1[OFF-HOOK.  
SWITCH ON MONITOR  
AND PHONE]
    D4 -- NO --> P2[OFF-HOOK  
AND SWITCH-ON  
PHONE]
    P1 --> D5{IS DOOR  
OPEN KEY  
PRESS}
    P2 --> D6{IS TALK  
KEY PRESS}
    D5 -- YES --> P3[SEND  
DTMF  
#20#]
    D5 -- NO --> D7{IS TALK  
KEY PRESS}
    D6 -- YES --> P4[ON-HOOK AND  
SWITCH-OFF  
PHONE]
    D6 -- NO --> D6
    D7 -- YES --> P5[ON-HOOK.  
SWITCH-OFF PHONE  
AND MONITOR]
    D7 -- NO --> D5
    P3 --> D5
    P4 --> D8{IS DOOR  
PHONE-  
dp  
AVAILA-  
BLE}
    P5 --> D8
    D8 -- YES --> P6[SWITCH-ON  
MONITOR]
    D8 -- NO --> D9{IS TALK  
KEY PRESS}
    P6 --> D10{IS DOOR  
OPEN KEY  
PRESS}
    D9 -- YES --> P7[ON-HOOK AND  
SWITCH-OFF  
PHONE]
    D9 -- NO --> D10
    D10 -- YES --> P8[SEND  
DTMF  
#20#]
    D10 -- NO --> D11{IS TALK  
KEY PRESS}
    P8 --> D10
    D11 -- YES --> P9[SWITCH-OFF  
MONITOR. SEND  
DTMF #dp#0]
    D11 -- NO --> D11
    P9 --> P7
    P7 --> J2(( ))
    J2 --> J1

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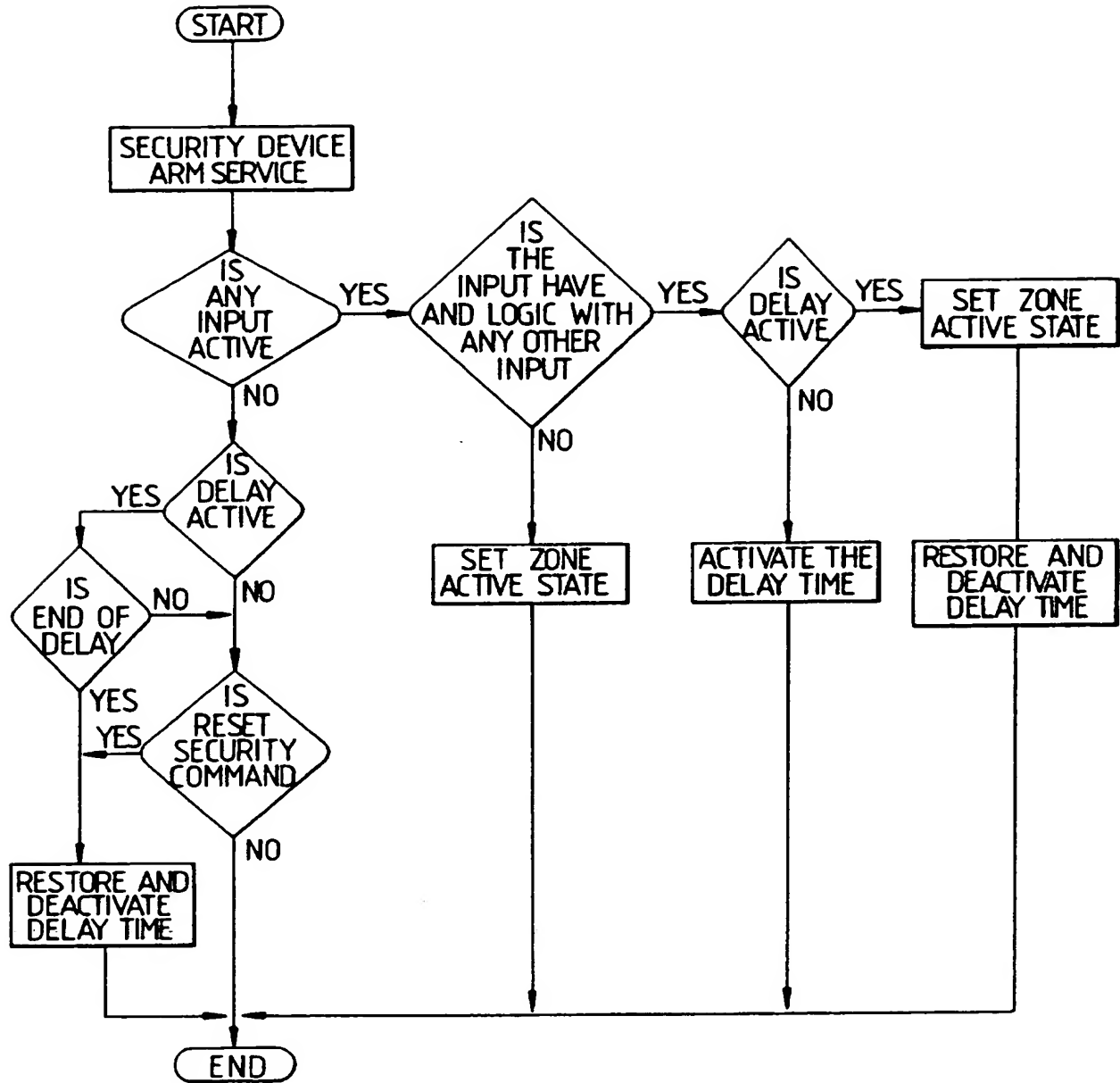


Fig. 11B

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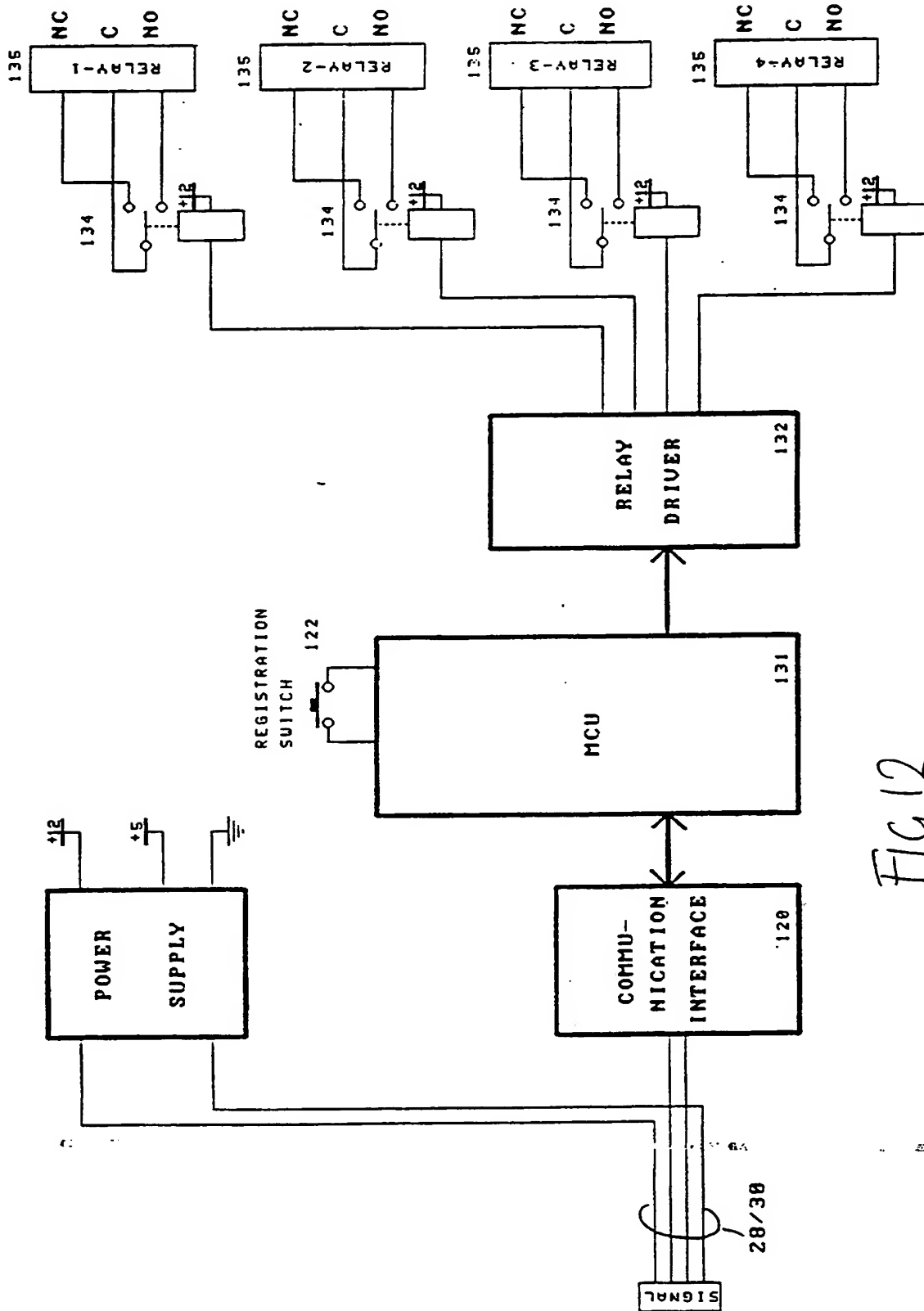


Fig 12

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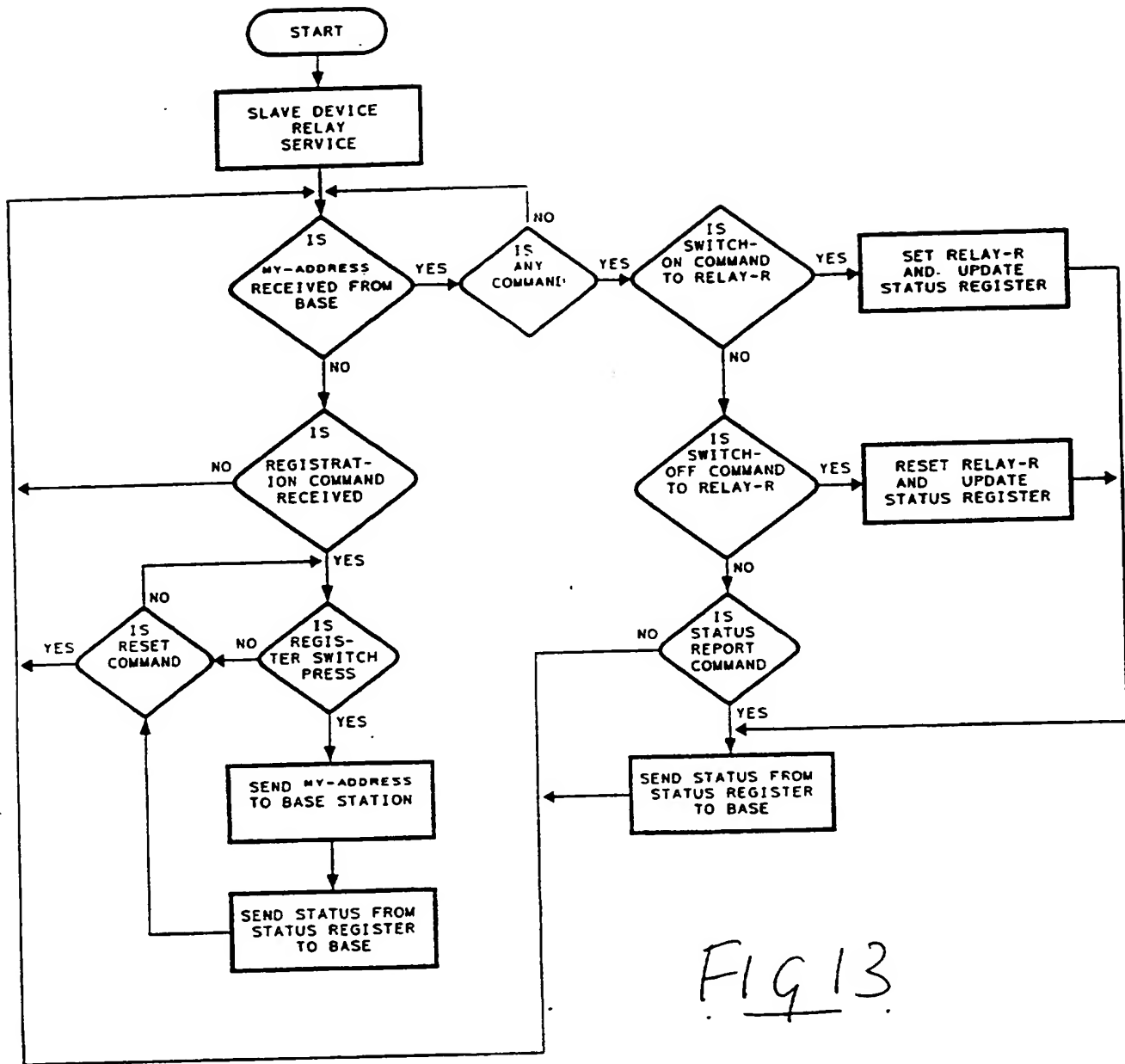


FIG 13

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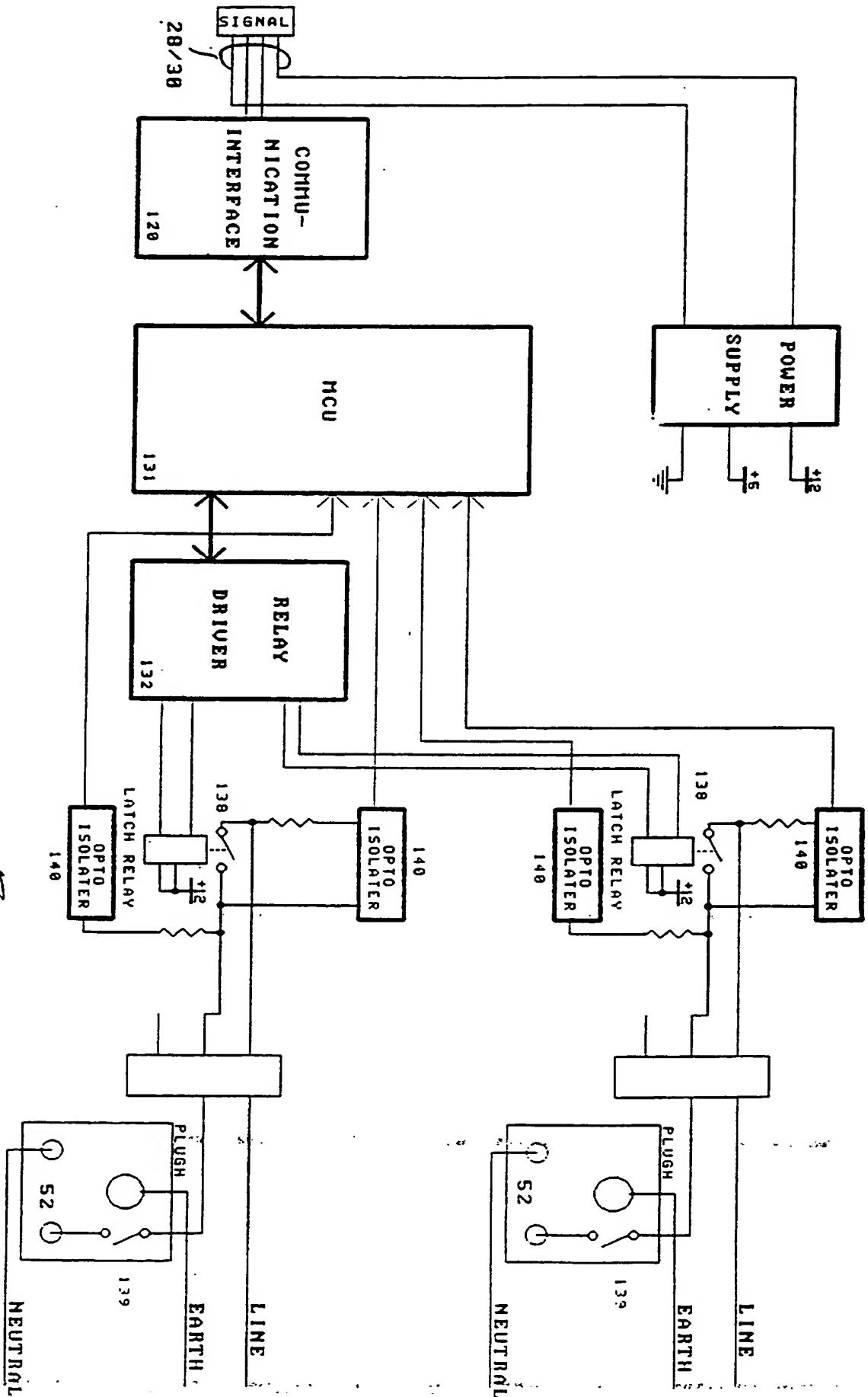


Fig 14

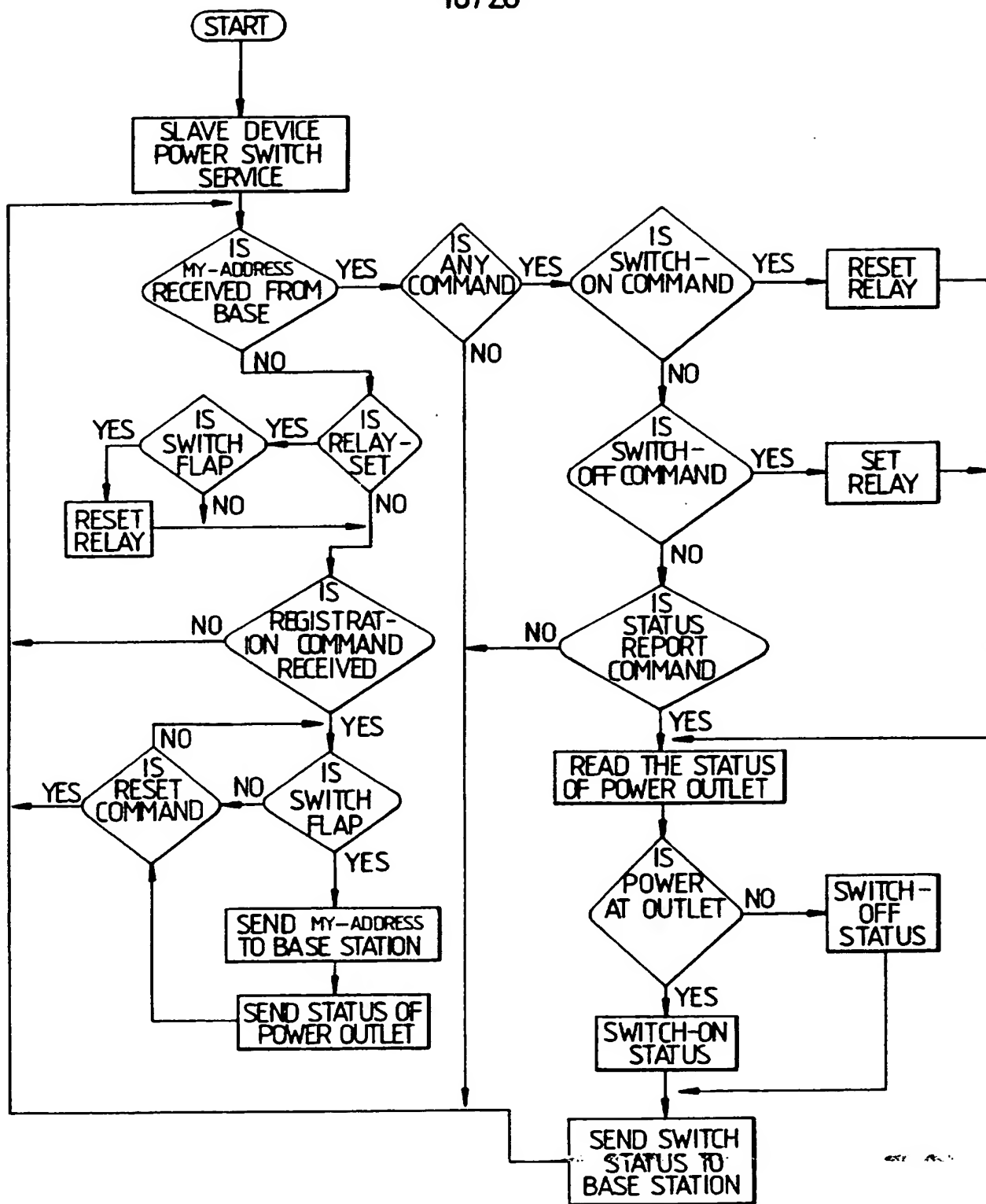


Fig. 15

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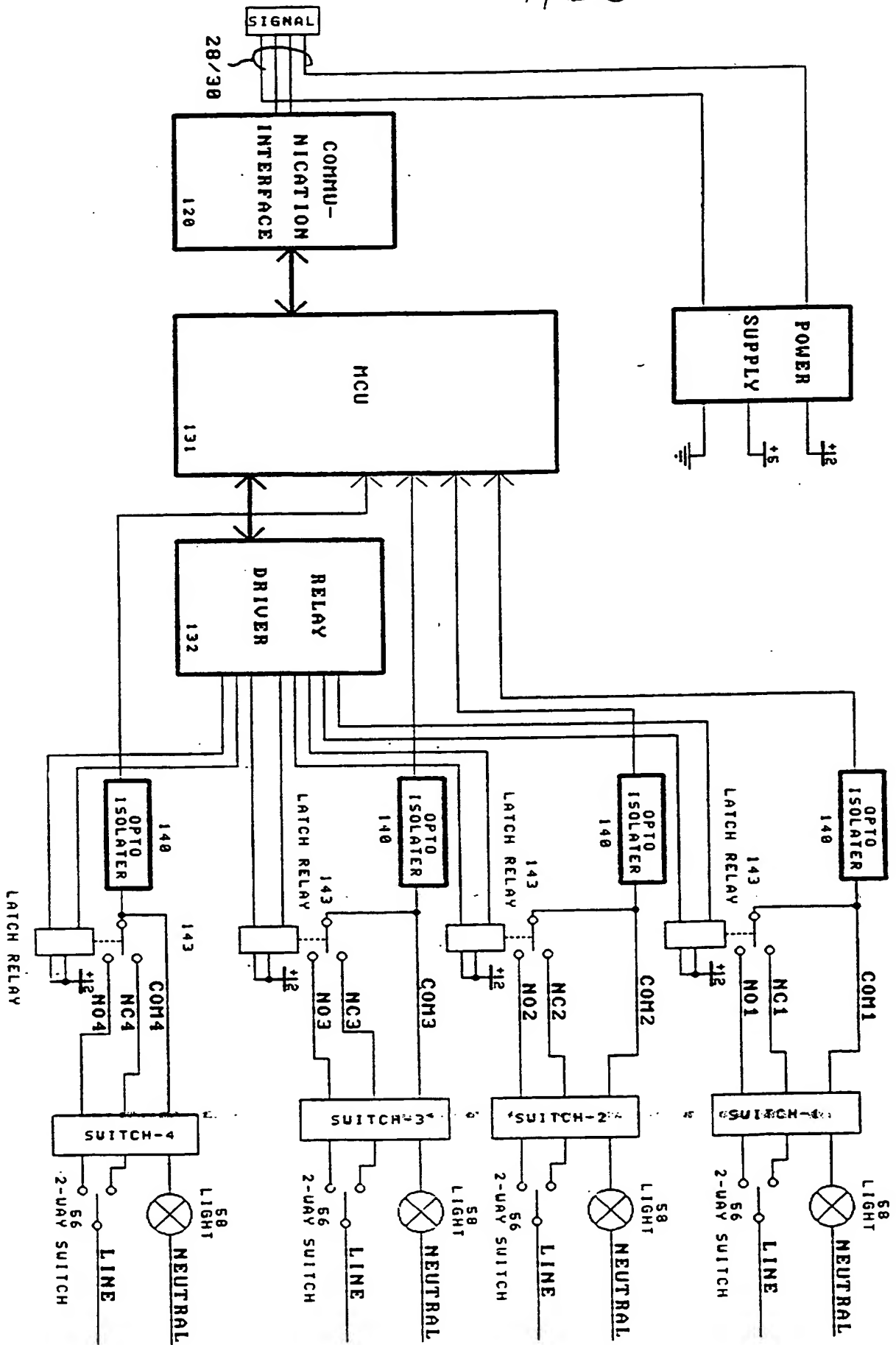


FIG 16

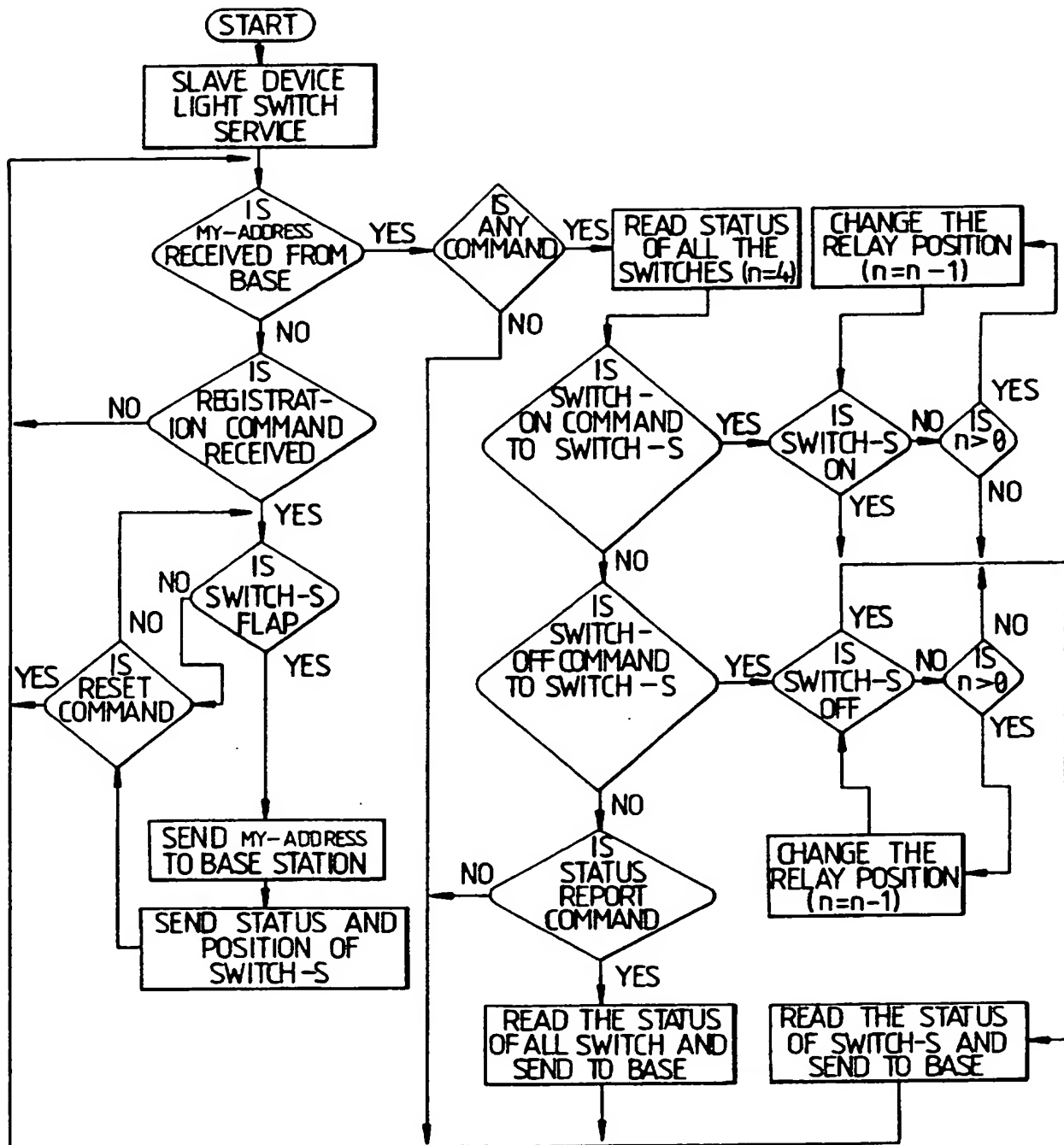


Fig. 17

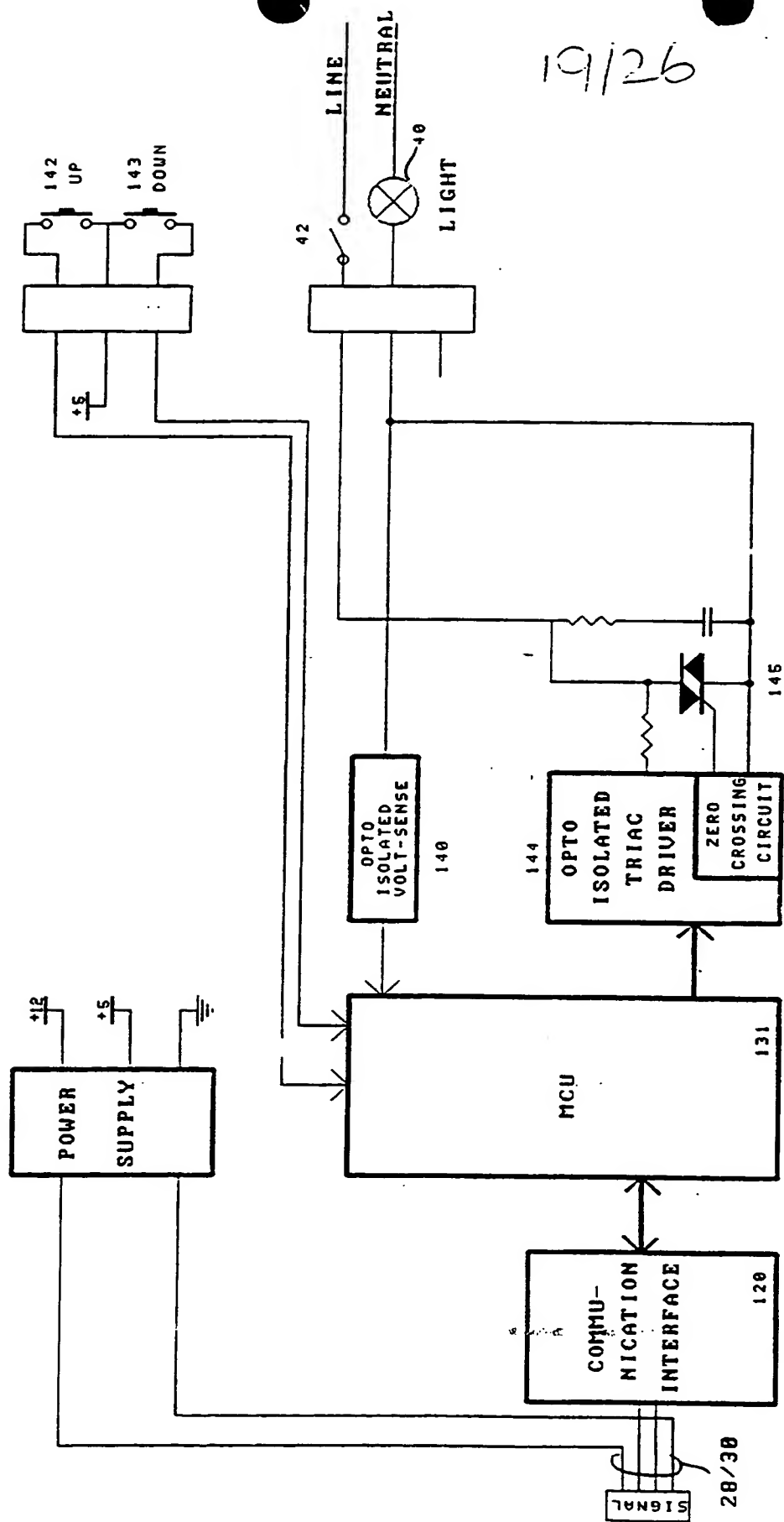
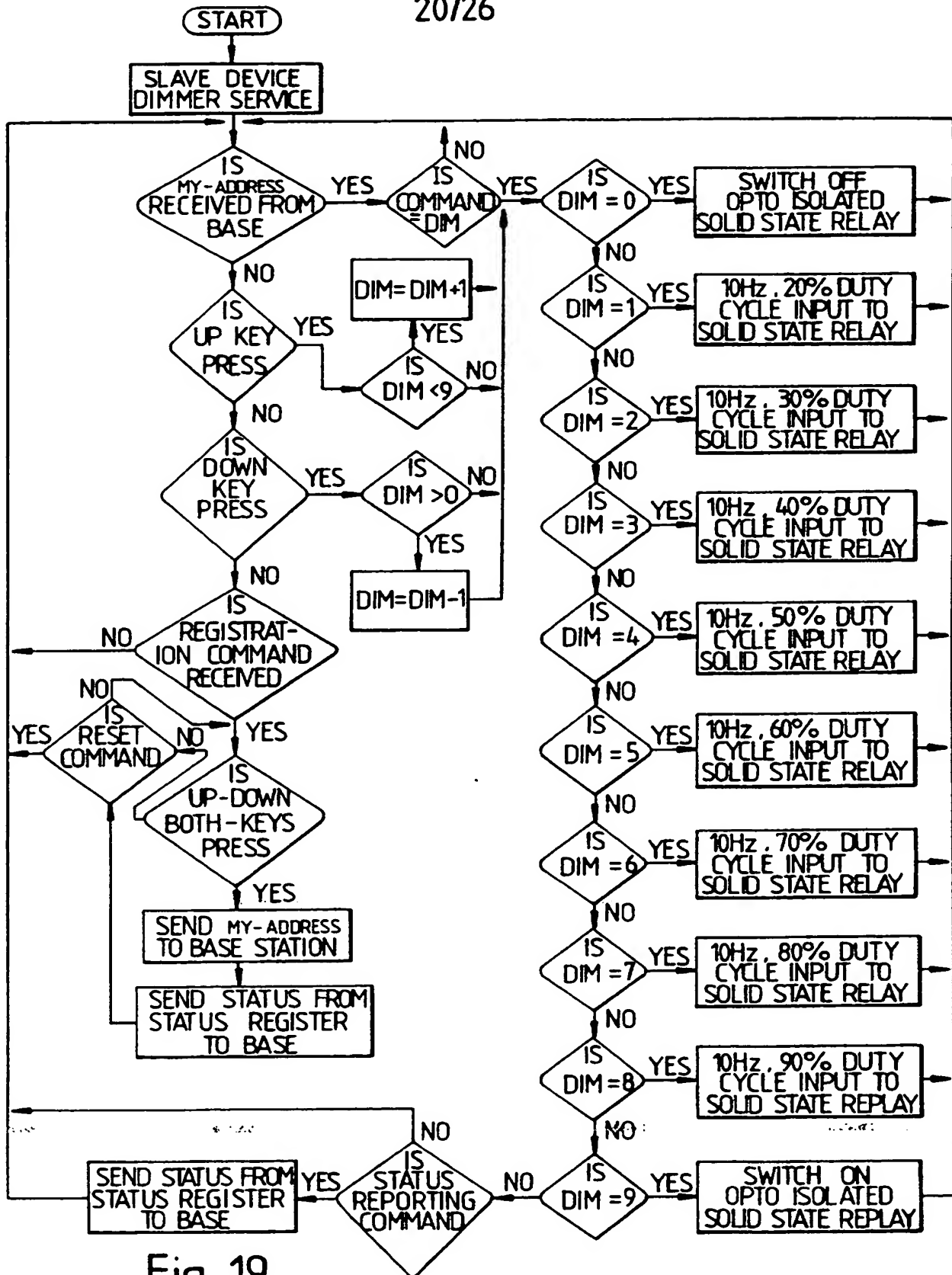


Fig 18

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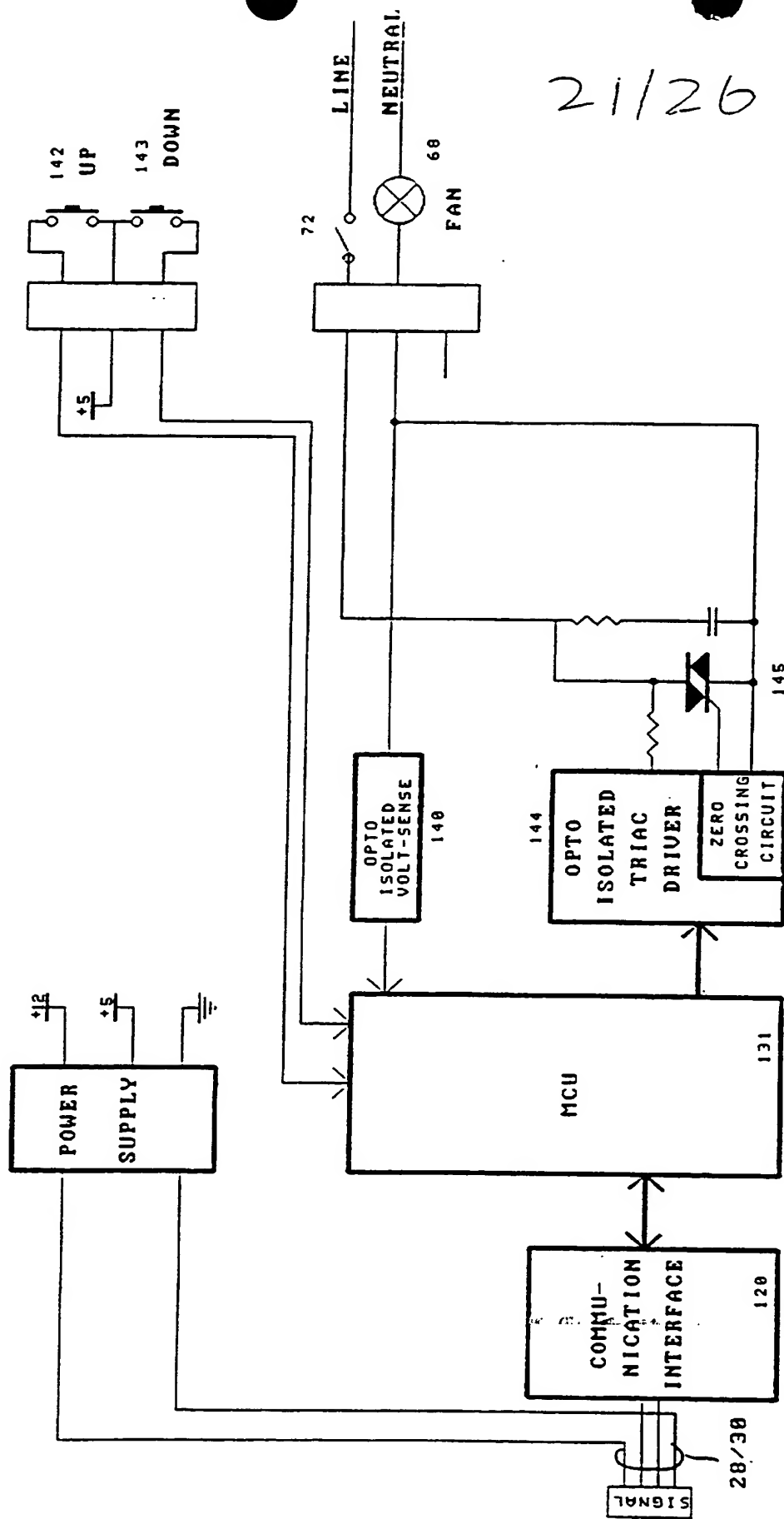


Fig 20

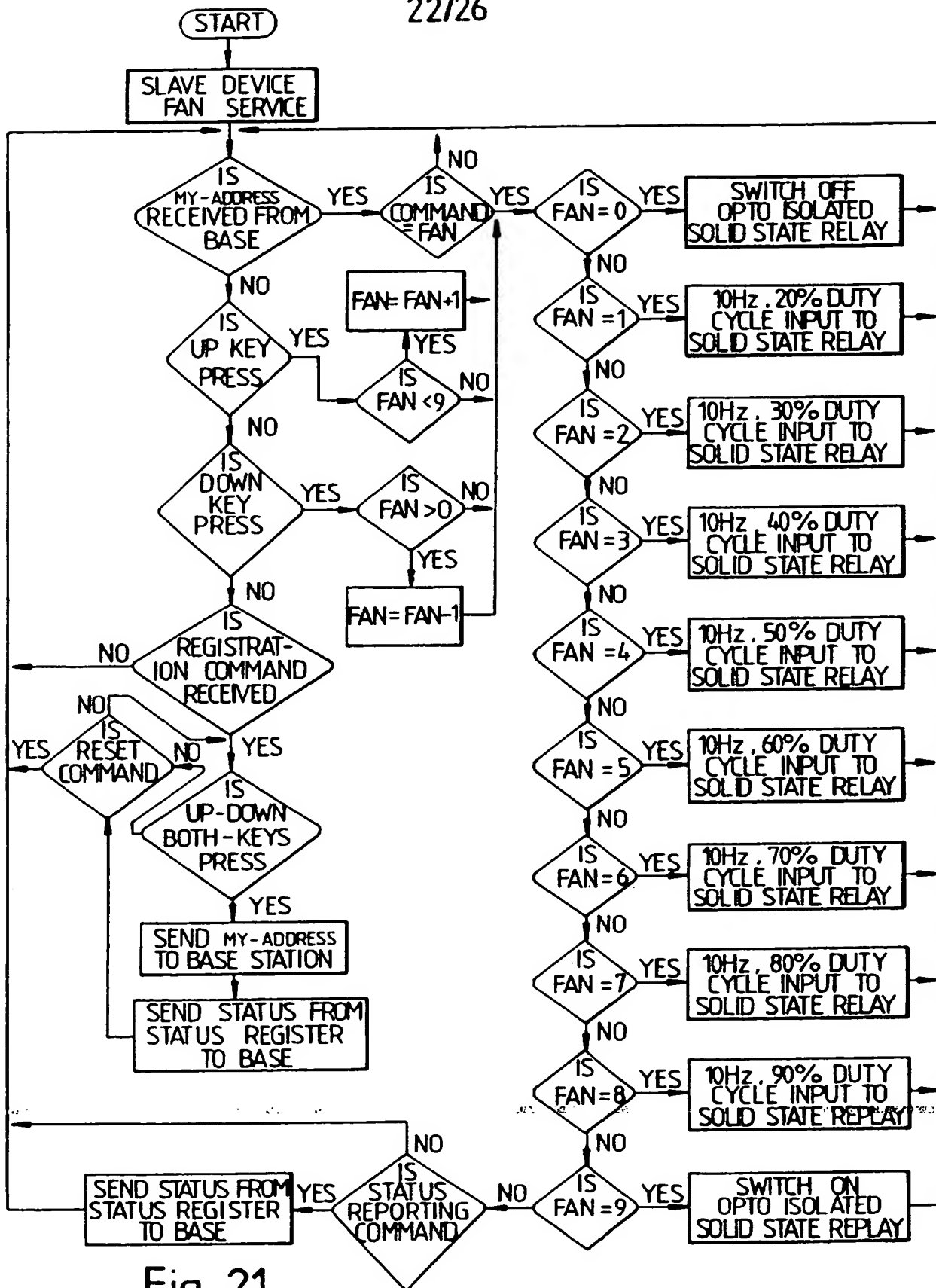
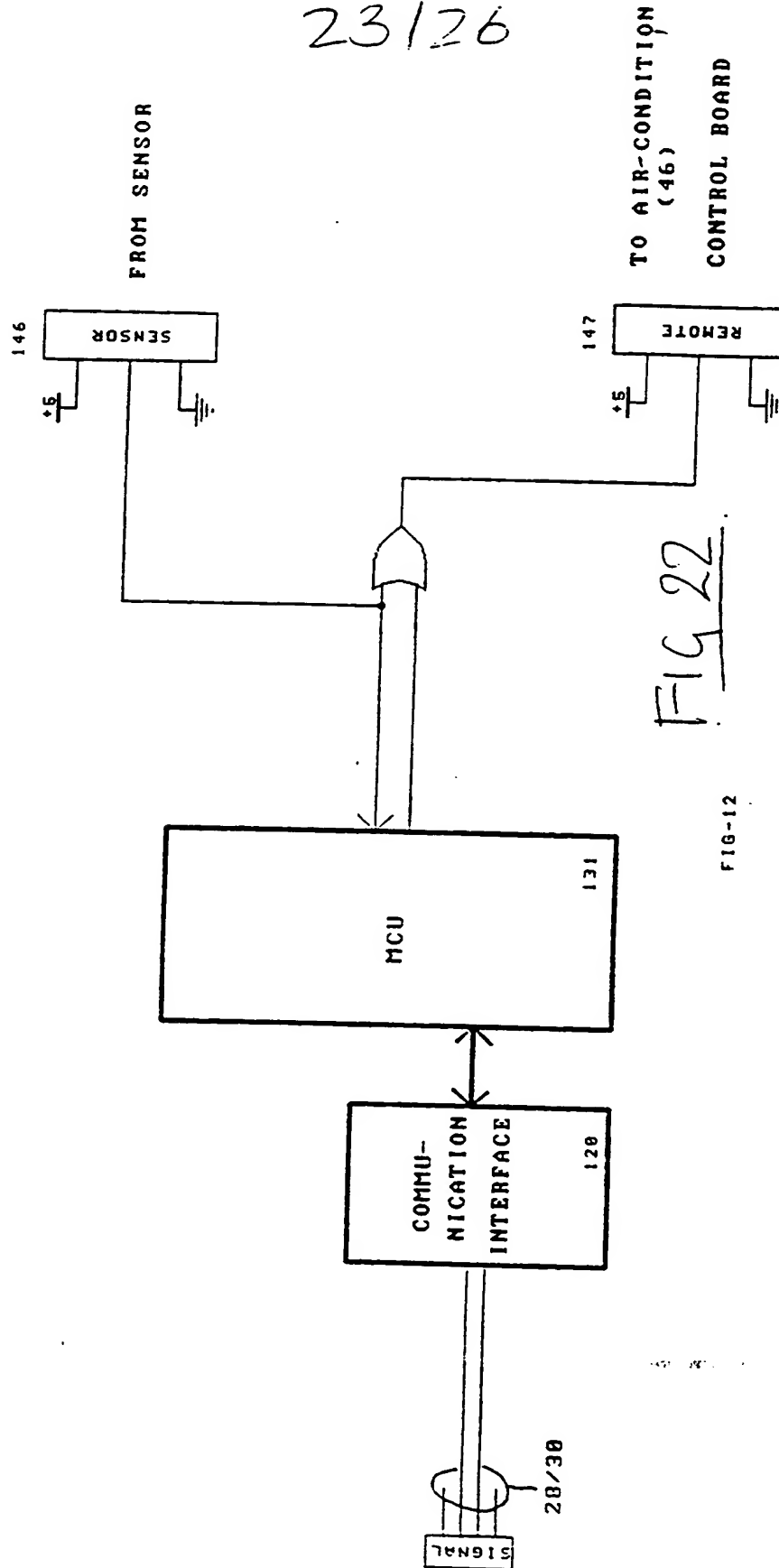


Fig. 21

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AIR CONDITIONER CONTROLE DEVICE
(CASP-AIRCON)

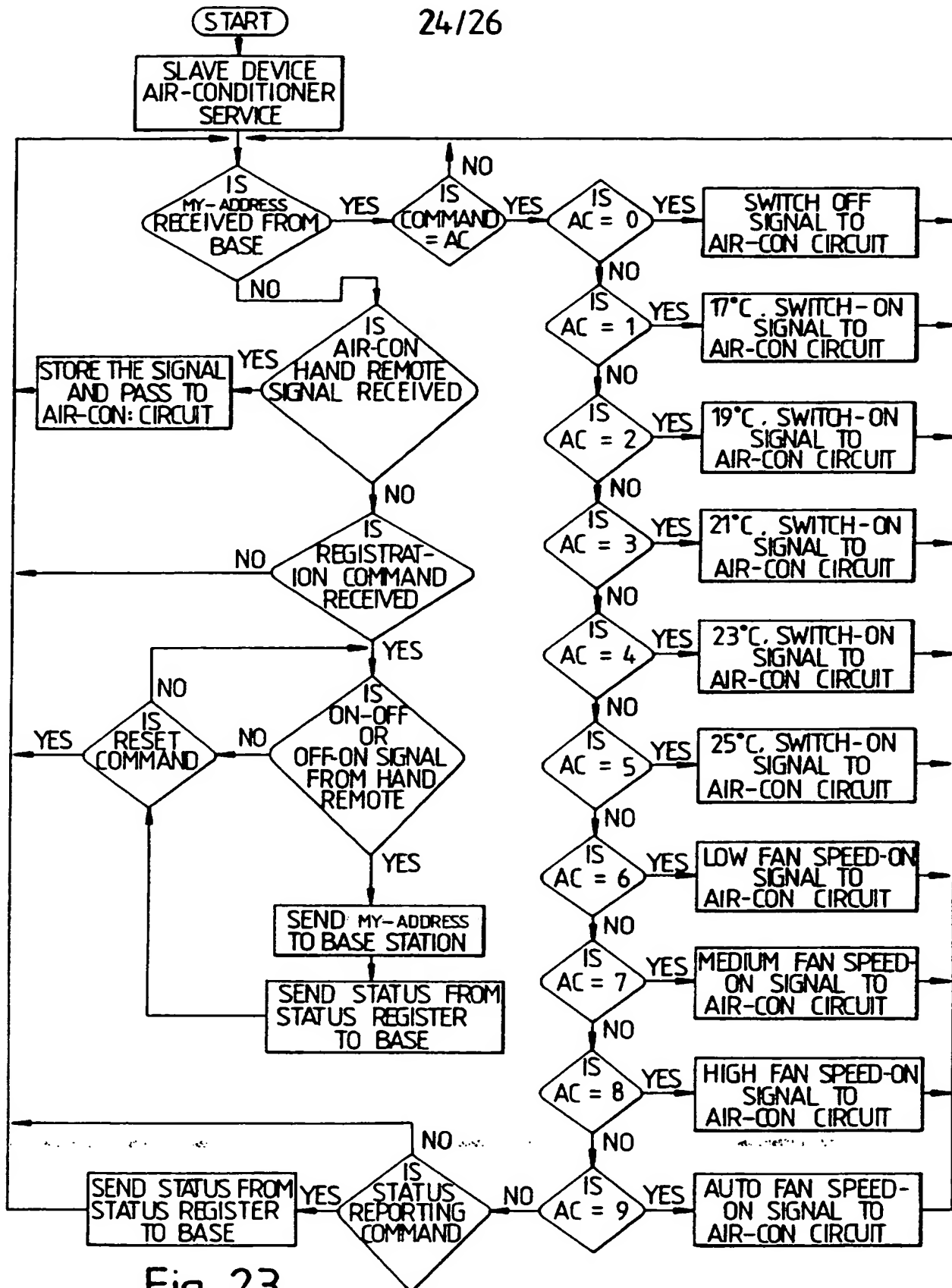


Fig. 23

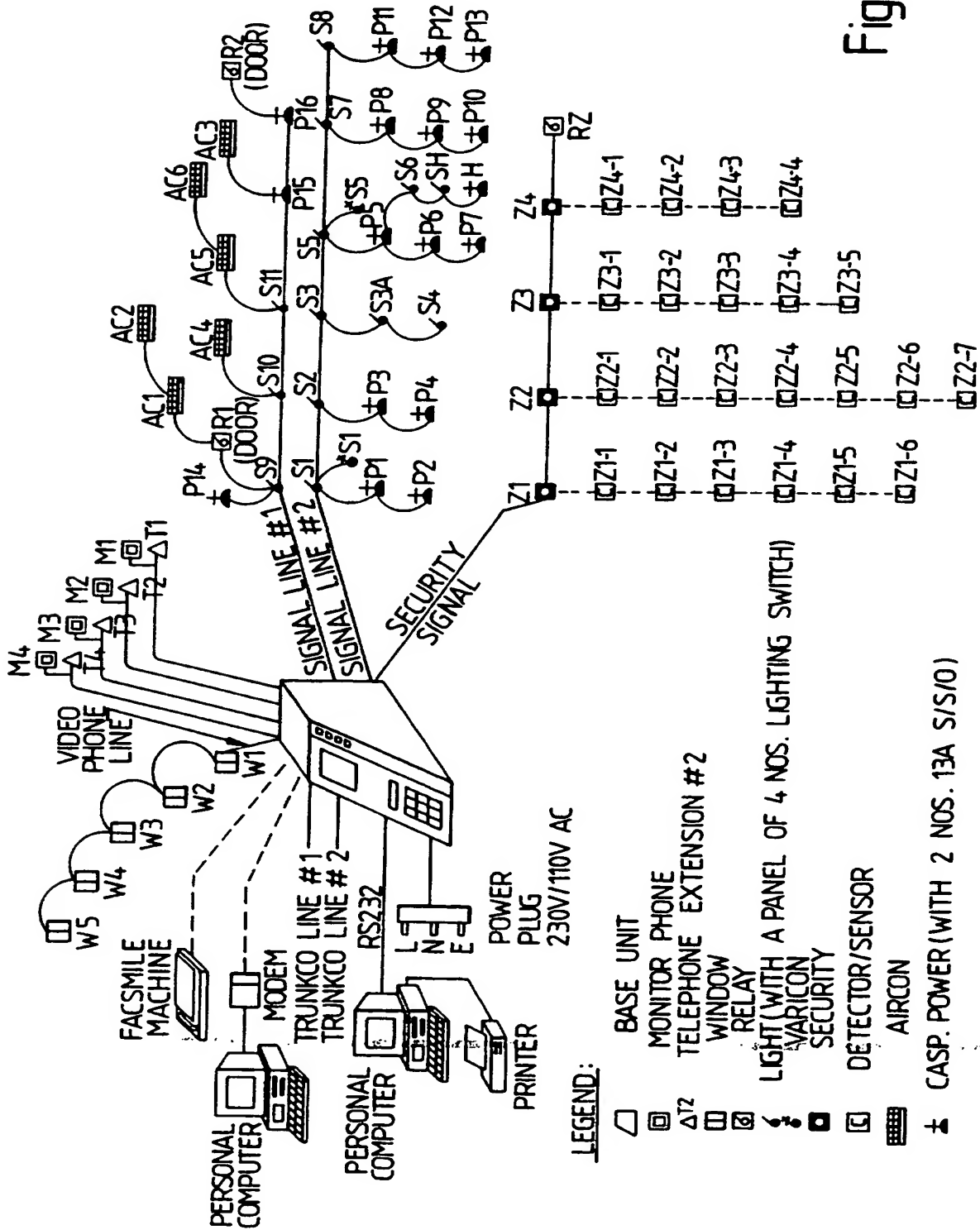


Fig. 24

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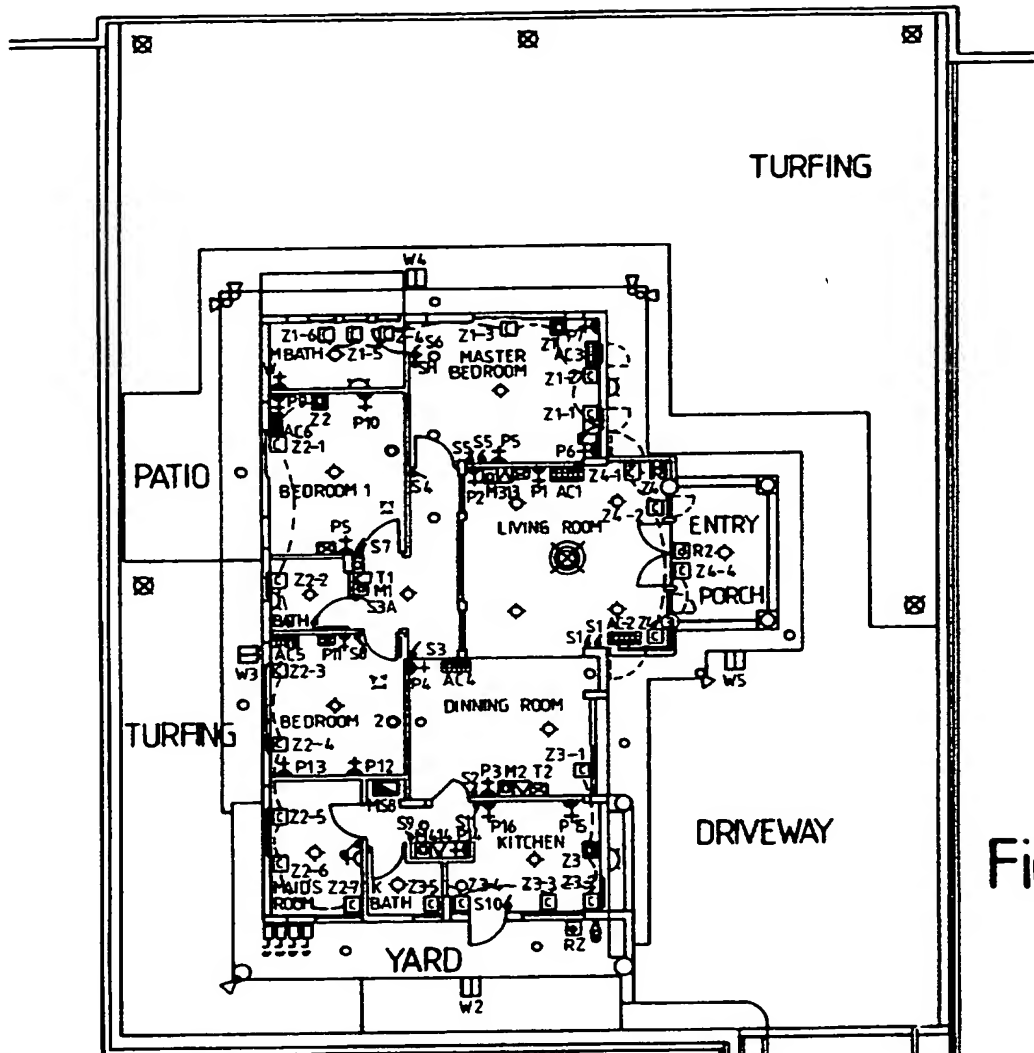


Fig. 25

LEGEND:

- SH 1 GANG 20A DP ON/OFF C/W NEON INDICATING LAMP FOR STORAGE WATER HEATER (MK BRAND ACCENT 2 WAY)
- SELECTED CEILING LIGHT POINTS
- SELECTED DOWN LIGHTS
- SELECTED DOWNLIGHTS POINT (INSIDE WARDROBE)
- SELECTED WALL LAMP
- SELECTED GARDEN LAMPOSTS
- SELECTED GATE LAMPOSTS
- SELECTED 100W SPOT LIGHT
- 13A DOUBLE-SOCKET OUTLET (MK BRAND ACCENT 2 WAY)
- 15A JUNCTION BOX AT HIGH LEVEL FOR STORAGE WATER HEATER (MK BRAND ACCENT 2 WAY)
- TELEPHONE SOCKET

FLOOR PLAN

- TELEVISION SOCKET
- WEATHER-PROOF ISOLATOR
- DISTRIBUTION BOARD
- SECURITY ALARM
- CASP.
- CASP. MONITOR
- CASP. WINDOW
- CASP. RELAY
- CASP. LIGHT (WITH A PANEL OF 4 NOS. LIGHTING SWITCH)
- CASP. VARICON
- CASP. SECURITY WITH DETECTOR/SENSOR
- CASP. AIRCON
- CASP. POWER (WITH 2 NOS. 13A S/S/O)

DOMESTIC MONITORING AND CONTROL SYSTEM

The present invention relates to a system for monitoring and controlling a domestic environment. In particular, the invention relates to the control and monitoring of electrical and electronic apparatus including heating, lighting, air conditioning and security apparatus.

For many years there has been a trend to equip ordinary houses with an ever-increasing range of electrical and electronic apparatus. For example, a modern house will typically have a far greater number of lights and telephones than its former equivalent, and may contain apparatus such as fax machines, air conditioners, and security systems which would not previously have been found in a domestic environment.

Despite this trend, little effort has been made to integrate the various electrical and electronic systems with each other. Typically, all electrical systems within a house will operate independently of one another. This means that it is a far from simple task for a house owner to appraise himself quickly of the status of the various electrical devices in the house with the consequence that confusion, or incorrect setting of the devices may occur. These deficiencies arise despite the fact that much of the electrical and electronic apparatus to be found in a domestic environment could be provided with sufficient intelligence to inform a user simply and

accurately of their status at any given time.

For example, it often happens that a house owner leaves home in a hurry and sometime later becomes
5 doubtful as to whether the house doors are locked, various electrical apparatus in the house (in particular heating and air conditioning) have been switched off, and the security system is properly set. If there is no one
10 in the house, the owner must either assume everything is as it should be, with the risk that it is not, or return home. Thus, the house owner must either waste time returning home or run the risk of his house being damaged by fire or burglars, or of energy being wasted.

15 It is also common for a house owner to leave home without a key and to lock the door without realising that this is the case, or for the door to shut unexpectedly. If the house owner does not have a spare key accessible, and there is no one in the house, it will be typically
20 necessary to make a forced entry with the result that damage will be caused, and security of the house may be compromised until such time as the locks are replaced.

Many houses now have door entry phone systems,
25 whereby a caller may talk to the owner of the house before being admitted. However, these systems may be inconvenient because it is often the case that the house owner is not close to an entry phone handset when a caller arrives. Additionally, if the house owner is out,
30 the caller typically receives no response and is left not

knowing the owner is absent or is not in a position to answer the entry phone.

5 The increased use of telephones has not led to a suitable solution to the problems which occur when a called person is absent, taking another call, or does not wish to be disturbed. Additionally, there are some calls which the called person simply does not wish to receive (for example, nuisance calls) which presently must
10 typically be dealt with by the telephone service provider.

Another well known problem which has become increasingly common in recent years relates to the use of
15 home security systems, the reliability of which is sometime less than may be desirable. In particular, it is well known that security systems are subject to false alarms which disturb neighbours and also have a desensitising effect, since those hearing an alarm which
20 has been subject to false alarms in the past are likely to assume that an alarm is false, even if it is not actually the case.

It is the aim of the present invention to provide an
25 integrated system which may provide solutions for or ameliorate some or all of these problems in an integrated and convenient manner.

The invention provides a domestic monitoring and
30 control system comprising a control unit; switch means

for controlling a piece of electrical equipment, the switch means being controlled by the control unit; the control unit being connected to a communication link, and being operative to change a state of the switch means so
5 as to modify the operation of the equipment in response to a predetermined action signal received from the communication link, and further operative, on receipt of a predetermined enquiry signal from the communication link, to apply to the communication link a response
10 signal indicative of a state of the switch means.

By means of this system, a user can not only control electrical equipment from a remote location, but also establish its status.

15

Preferably, the switch means is operative to control more than one piece of electrical equipment and/or to control more than one function of a piece of electrical equipment, distinct action, enquiry and response signals
20 being associated with each appliance and/or function.

In a preferred embodiment, the communication link may be adapted for connection to a private or public telephone line. In this arrangement, the home owner may
25 communicate with the system from any location at which a telephone is available. In such embodiments, the action and enquiry signals may comprise telephone dialling signals (such as DTMF signals). In this way, the user may send signals to the system by pressing appropriate
30 keys on a telephone key pad. Conveniently, the response

signal may comprise an audio signal, most conveniently a speech signal. Such a speech signal may be synthesised or may comprise a recording. This allows the home owner to interpret the response signal without any need for mechanical translation.

The system preferably additionally includes sensors which monitor the status of items not under its direct control. For example, sensors to determine whether a door of the house is locked. In this way, a house owner may obtain detailed information on many aspects of the status of the house.

Additionally, there may be provided remotely operable locks for securing and releasing under the control of the system, an entry door to the house. Each of such locks most preferably is operative to generate a feedback signal for detection by the control unit in confirmation of the status of the door under its control. In this way, confirmation can be obtained that a door has, in fact, been successfully locked, and has not, for example, been left open. Thus, the house owner can not only lock and unlock the house remotely, e.g. by a hand-held or external telephone, but can also verify that the house is secure in his absence.

The system may comprise telephone "switching" means connected to one or more telephone instruments within the house and to an external line of the public switched telephone network. In such embodiments, at least one

local telephone instrument may be a door entry phone, the system being programmable by a house owner such that on the entry phone being activated by a caller to the house, a connection is made between the entry phone and a pre-selected one or more internal telephone instruments and/or a predetermined number on the public switched telephone network is called. A user can, in this way, specify that when the entry phone is activated, a nearby telephone instrument is connected thereto or, when the user is absent from the house at a known location, the user may specify that they are automatically connected by telephone to the entry phone when it is activated.

Additionally, the system may comprise means for detecting a calling line identifier signal on a line connected to the public switched telephone network on receipt of a call from that line, storage means for storing a plurality of calling line identifiers associated with callers to which the user wishes to send a predetermined message, the system being operative to release the message to the caller. Persistent nuisance calls may be filtered out by a programmed action. The system may further comprise storage means for the calling line identifiers of known callers and data identifying those callers. When an incoming call is received, the system searches the storage means for a matching calling line identifier, and if a match is found, the identifying information is displayed to the user so that the user is informed of the identity of the caller prior to answering the call. Additionally, the system may have automatic

answering and message taking systems built in.

At least one of the switch means may not be connected with any equipment but may establish connection with the communication link. These may be called indirect switches. The action and state of these indirect switches can be programmed to associate with some of the switch means connected with equipment and with the communication link. The state and position of the indirect switch thus effectively controls the equipment. This way more than one indirect switch associated with one appliance or equipment may establish a multiple-point switching circuit without actual multiple-point power control wiring for that appliance or equipment. The programmability of the system may give the flexibility that the function defined for one indirect switch may be changed in future without change in the wiring associated, to implement the function.

An indirect switch can also be programmed to function as security armed control of a particular zone or to initiate a group of functions that implement a pre-defined sequence of actions. The actions might include the execution of possible functions of the system and/or the functions of the devices integrated within the system in a pre-defined manner, such as an auto-dial function on breach of security followed by security alarm and activation of the area floodlighting fixtures. This group function may start to monitor for breach of security after the programmed indirect switch is put to

"on".

The security device includes an electronic interface device, which is used to monitor the logical state of one or more sensors and compare with the pre-defined security breach condition and apply the active state of sensors and breach of security to the communication link. The breach of security state is determined by detecting more than one pre-defined sensor input within the preset time. This means of conforming security breach condition with one another different kind of sensor effectively eliminates the false warning without loss of the reliability.

The control unit may execute a predefined sequence of action on indications of security breach state from the security device. A user may define this sequence of actions, for example, to send to an internal telephone extension or to a known external telephone with a pre-recorded message, such as the address and location of the house, or inform to the user by paging a security zone number, and/or activate an alarm device, light, etc.

On request, the user may be informed by, for example, a synthesized voice of the state of any switch or state of appliance integrated with the system or active state of security sensor through any internal telephone extension or remote telephone or at control base-phone station. The user may operate any appliance or arm a security device to monitor for breach of

security from any internal telephone or from remote external telephone. The acknowledgement of the given operative or inquire command is delivered as a voice message of the operated device state, after the execution
5 of the given command. The open or closed state of a door or window can be determined from the active state of the associated security sensors fixed at the door or windows. If a motorized power-window or door is installed and interfaced with the communication link, then the user can
10 operate the motor to close or open that window or door.

The door access control is an integral service of the system. It operates through a relay unit of the system, that interfaced with the electric magnetic lock
15 or door latch. The relay unit is a switching device that acts as a means for establishing the communication link with the control base-phone station and it is operative from the control station. The user may operate the door access control from any internal telephone extension or,
20 after giving a valid pass-code, from the remote external telephone.

A door-phone unit or the camera-phone unit comprises a charge coupled device (CDD) infrared camera, and a
25 hands-free phone with a call button. The visitor at the door can alert the user by pressing the call button. The user can communicate to the visitor from any internal telephone or from a monitor-phone which is interfaced with the extension line or from the control base-phone
30 station. The view of the visitor captured by the CCD

camera is displayed at either the control base-phone or the monitor-phone and from which the user is communicating with the visitor.

5 In many cases, the door-phone may be installed in an unsecured area, where it is vulnerable to tampering. To avoid the risk that an injected signal illegitimately applied to the communication link could cause the system to fail, the communication and the power lines to the
10 door-phone are completely isolated from the rest of the system. Moreover, the programmability has the flexibility to assign or change the address of a door access control device for any door-phone and gives no hardware link between the door-phone and the door access
15 control, so that by tampering the door-phone one cannot gain access through the locked door.

The user may program the door-phone for a pre-recorded synthesized voice message in response to the
20 visitor call for his further action such as "please wait, or leave a message". If any message is left, it will be recorded and delivered to the user at later time on his request. The user may also program the doorphone to call and/or inform to a known telephone or to a mobile hand-
25 phone or to a pager. In this way, the user is able to communicate with the visitor who is waiting at the door of his premises, by giving the appropriated operative instructions after a valid pass-code being entered by the user from any external remote telephone.

The system comprises the telephone switching means, and to establish voice communications and/or data communications between external public switched network, to one or more internal telephone instruments and/or
5 computer modem, one facsimile machine, one or more monitor-phones through its assigned extension lines, one more door-phones through video phone line and appliances, security devices, and also the door access control through digital communication link. The telephone
10 switching means also to establishes voice communication in-between one or more internal telephone instruments, one or more monitor-phones, one or more door-phones, and data communication to appliances, security devices and door access control through digital communication link.

15

The DTMF signal from internal telephone or external telephone is interpreted as operative instructions for the system and its associated devices. Any operative instruction from external telephone line for its
20 associate devices such as door access control, security device, lighting switches, etc. is accepted after confirming the right user by a valid pass-code. In such embodiments the incoming fax call is auto-routed to the facsimile machine after detecting the fax signal. The
25 external line also monitored for Calling Number Delivery (CND). The CND signal is used as data for displaying incoming telephone call numbers, selective call redirect and delivery of pre-recorded message for specified incoming calls. All incoming calls are monitored for CND
30 signal and if available that may be displayed at base-

phone station for the user to aware the identity of the call before he attend to that call. If CND data of any incoming call is matched with pre-programmed call redirect telephone number, that call may be redirected to another known telephone after success in establishing communication with the known telephone. This feature may discourage the nuisance calls, if such calls are redirected to police station, or this feature may be used to redirect an expected and important call to the user at his mobile hand-phone or to a telephone at known location when the user leave the house. The user may not wish to personally attend to some incoming calls, such as nuisance calls and so forth. Such a call may be attended to by a voice mailing system assigned for that call. This feature is given a name and it is called the "Caller Mail". This feature may deliver a pre-recorded message to an incoming call that matched with the specific CND number and records if any answer is available from that call. This feature may also discourage the nuisance calls, easy answer to the debt collector's call or pass an important message to a special incoming call. This kind of message exchange is implemented in the voice messaging system (VMS).

The voice messaging system (VMS) is the means of organizing the digitized voice signal as data of message kept in memory. The VMS records, delivers and synthesizes voice signals in a pre-defined sequence to form a meaningful message. Multiple voice mailing is implemented in the VMS, such as each extension phone

station is assigned for one individual voice mailbox. This feature is given a name and it is called "Personal Mail". Similarly, voice mailbox for selective incoming calls, it is called "Caller Mail"; and voice mailbox for
5 unspecified incoming calls, it is called "General Mail".

The voice mailbox means the storage media that may be a semiconductor memory which receives the voice messages on behalf of the user and delivers the received
10 message to the user at latter time on his request. The incoming calls from external telephone or internal telephone may specify any extension line of his interest as DTMF data, if the user of that extension telephone is not available or he does not want to be interrupted then
15 the Personal Mail assigned for that extension line will deliver a pre-recorded outgoing message and receive any answered message, if available. The received message can be heard either from the assigned telephone extension or from remote telephone after giving a valid pass-code
20 assigned for that extension. Since each extension is assigned with the individual voice mailbox and its pass-code, the privacy of message is retained. The same pass-code may be used for entry access into the system at any remote telephone, so that user may not remember many
25 pass-codes. The system may be accessed by more than one pass-code, but typically not more than eight pass-codes.

The incoming calls from external telephone, which are not specified or not interested on any extension
30 telephone, will be attended by the General Mail, if

nobody at home had attended to the calls. The outgoing message of General Mail may advise the caller to specify any extension number. If the caller should specify the extension number, the answer may be recorded at the
5 respective Personal Mail otherwise it may be recorded at the General Mail. The recorded messages at the General Mail can be accessed from any extension telephone or from the remote external telephone after entering a valid pass-code, which may be assigned for any personal mail.

10

A "Do Not Disturb" feature may be associated with voice mail once Personal Mail for one telephone extension is active, that telephone extension may not ring. All calls coming to that extension may be attended by the
15 Personal Mail. If General Mail is active, no telephone may ring for any incoming call from an external telephone. If Caller Mail is active, only the call that matched with the specified CND will be attended by the assigned voice mail.

20

The voice mailing system will act as a call screening system, referred to as "Screened Mail". If the user is busy or does not want to attend to any call directly, he can activate the Screened Mail system, so
25 that any call coming in to his extension, will receive the pre-recorded outgoing messages from the Personal Mail and if any answer received for him that may be delivered to him immediately by ringing the telephone. If this feature is active for the General Mail, all incoming
30 calls from external telephones are screened and if the

answer is recorded at Personal Mail, only that assigned extension telephone may ring and deliver the message; or if the answer is recorded at General Mail all the telephone extensions may ring and deliver the message to the telephone extension that pickup first. If the screened mail is active for caller mail, only the specified calls may be screened and if any answer is received all telephone may ring and the message may be delivered to the first pickup extension.

10 .

The control base-phone station may comprise a hands-free phone. Call can be made from it or call can be received at the base-phone. The base-phone acts similarly to any other extension but there is no Personal Mail assigned to it, and only the General Mail is available for access to it. A call made from the base-phone may have the additional feature similar to re-dial, but if an engaged tone is received it re-dials again and again until the attempt is successful. This feature is referred to as "Repetitive Dial". The last call number made at the base-phone or the set of telephone numbers stored in the memory telephone directory can be called for repetitive dialling. This feature increase the probability to communicate through high communication traffic of the telephone lines, such as overseas calls.

The integrated system comprises may include a security alert system, a distributed power control system, a private automatic branch exchange, a voice messaging system and a door monitoring and access control

system. The programmability to allow these systems to interact with one another gives the flexibility and value added solution to user's requirement.

5 From a real-time clock, timer functions can be programmed to any associated devices, such as light, air-conditioner, heater, etc. The timer can be programmed for hourly, daily, and weekly schedule to activate any device or arm for security control, or initiate any group
10 of devices for sequential operation.

 The programmability of a sequential group gives a wide range of applications, and is flexible to meet the user's requirements and the associated devices integrated
15 with the system.

 The features which are described below by way of example and they are executed by programming with few actions in a group: a delay can be programmed for cooking
20 so that the cooker can be switched on and off automatically; and similarly a delay and a timer may be set for the door device unit, such that after a predetermined time, if any visitor should press the door-phone call button, it immediately activates the entrance
25 or the corridor lighting with delay timing for switching off automatically.

 A doctor can be called on emergency by programming his telephone number with recorded voice messages, this
30 group programming may be initiated if a panic-button or

an emergency switch is actuated. Similarly, police can be called upon activation of a panic button. Dimmer deice can be programmed to change the illumination intensity as per the states of other lighting switches, so that when other lights are switched on, the dimmer may automatically reduce the intensity of illumination. A single security breach may alert the user. If more than one security breach occurs, the system may call the police, with a suitable pre-recorded voice prompt messages to inform them. The part of the house or zones may be lighted as soon as the illegal intruder enter in to the house and if he move in to the next zone that zone may be lighted and followed by siren associated to that zone.

A cooking sequence may be programmed in a group, and the sequence may be initiated from the remote phone before the user returns to the house. The cooking sequence may be explained with an example. A rice cooker may takes more time than a roasting oven or a kettle. These appliances are programmed such that the rice cooker is switched on first, followed by roasting oven. The roasting oven is switched off with an appropriate time delay and with more delay the rice cooker is switched off. The kettle is then switched on. If the user activates the program, from his or her office, the food may be just ready for dinner when on return to the house.

An embodiment of invention will now be described in detail by way of example with reference to the

accompanying drawings in which:

Figure 1 is a diagram of a known home automation system of the switching type;

Figure 2 is a diagram of a known home automation
5 system of the ripple type;

Figure 3 is a block diagram of the major functional components of a home automation system embodying the present invention;

Figure 4 is a more detailed diagram of the system of
10 Figure 3;

Figure 5 is a hardware block diagram of a base unit for use in the system of Figure 3;

Figure 6 is a hardware block diagram of a door phone unit for use in the system of Figure 3;

15 Figure 7 is a flowchart of the operation of the unit of Figure 6;

Figure 8 is a hardware block diagram of a monitor phone for use in the system of Figure 3;

Figure 9 is a flowchart of the operation of the unit
20 of Figure 8;

Figure 10 is a hardware block diagram of security devices for use in the system of Figure 3;

Figures 11A and 11B are flowcharts of the operation of the devices of Figure 10;

25 Figure 12 is a hardware block diagram of a relay switch for use in the system of Figure 3;

Figure 13 is a flowchart of the operation of the unit of Figure 12;

Figure 14 is a hardware block diagram of a power
30 switch for use in the system of Figure 3;

Figure 15 is a flowchart of the operation of the unit of Figure 14;

Figure 16 is a hardware block diagram of a light switch for use in the system of Figure 3;

5 Figure 17 is a flowchart of the operation of the unit of Figure 14;

Figure 18 is a hardware block diagram of a light dimmer for use in the system of Figure 3;

10 Figure 19 is a flowchart of the operation of the unit of Figure 18;

Figure 20 is a hardware block diagram of a fan speed controller for use in the system of Figure 3;

Figure 21 is a flowchart of the operation of the unit of Figure 20;

15 Figure 22 is a hardware block diagram of an air-conditioning controller for use in the system of Figure 3;

Figure 23 is a flowchart of the operation of the unit of Figure 22;

20 Figure 24 is a diagram of the interconnection of the above devices in the system of Figure 3; and

Figure 25 is a floor plan of a building incorporating the system of Figure 3.

25 Figure 1 shows the overview of existing switching home automation products, from which it has a control box (normally it is known as a black box) with radial wiring to each device, each station and each equipment, and with an attached programmable telephone control console
30 equipment. The security system shows the wiring to each

sensor/detector and the zoning of the system is at the control box. Similarly, the home automation system has the same manner of wiring to the device/equipment; and also the door access control system. The home PABX
5 allows 4 to 8 extension phones.

The existing available products do not allow for the same features offered by the present invention, and in particular for the integration of PABX with the voice
10 messaging system, the multiple voice mailing system, and the caller number identification system. The control box is the main control panel in which the electronic cards of the systems are installed. It has limitation and has less input and output points capacity and also less
15 features and functions.

Figure 2 shows the overview of existing ripple-type of switching home automation products. The disadvantage of the ripple system is that the ripple voltage will
20 create unnecessary interference that disrupted the data transmission of the computerised equipment, such as the personal computer. The drawing shows the ring main circuit wiring for all the power points and that ripple receiver, sender and the programmable timer are connected
25 to the ring main power circuit. This wiring configuration has shown the restriction for which PABX and other systems are not available. It is not versatile and has limited features and functions.

30 The major functionality of a system embodying the

invention can be categorized into three major functional blocks as shown in Figure 3. The administrator (1) that is one of the functional block that holds the complete control over the system and it exchanges the information with the other two functional blocks namely Private Automatic Branch Exchange (PABX) (2) and Voice Messaging System (VMS) (4); and as well as all the external slave devices which are connected to the networks and formed the integration for the operative system. The PABX (2) interfaces the central office (CO) trunk lines and the home telephone instruments to the system. The VMS (4) stores and delivers messages in pre-defined sequence. The administrator (1) receives information and sends control signals to the PABX (2) and VMS (4) through digital interface (3). The VMS (4) and PABX (2) are interfaced with analog link (5) for reproduction of recorded or synthesized voice signals.

SYSTEM OVERVIEW:

The whole complete system and its supported applications are represented in the block diagrams as shown in Figure 4. The system comprises a main control base phone unit (10) which has two CO-trunk lines (12) for public telephone networks connections; eight extension telephone lines (14) for connections with private telephone instruments, such as telephones (26), monitor phone (24), computer modem (22), and additional PABX; a fax line (16) for connection with facsimile machine; two slave communication networks signal lines

(28,30) for connections of the slave devices, such as light switch control (54), a power switch control (48), air conditioner control interface (44), relay switch (60); light intensity dimmer (38), and fan speed regulator (70); a security signal line (20) for connections of the security interface modules (34); and a video phone line (18) for connections of the door phone (32). The security signal line (20) and video phone line (18) will have the battery backup power supply to the connected devices' interfaces. In addition it has two RS-232 standard digital interfaces (74) for the personal computer (76) and/or mimic panel (78). The mimic panel can control and/or display the status of all slave devices. The PC or the mimic panel is used for updating programmable entries and can also be used for accounting the consumption of the power utility and for the amount of the telephone calls that had been made.

The physical networks link with all devices. The devices are connected to the networks signal lines (28,30) and the security signal line (20). It is not necessarily following the double end terminated backbone architecture. The signal line can be wired similarly to a normal household electrical wiring installation, except that there should not be any loop. It means that no two opened end signal wiring branches can be joined and connected to form a closed loop. These signal lines (20,28,30) are having four wires bus-architecture, one pair for power distribution and another pair for signal distribution.

The hardware block diagram of control base phone unit (10) is shown in Figure 5. The base phone unit consists of the required audio interface which is for CO-trunk lines (12), audio and video interfaces are for operating the respective extension telephone lines (14) and video phone line (18), fax interface is for fax line (16), communication interface is for slave device networks signal lines (28,30) and security signal line (20); and RS232 interface for RS232 ports (74). The built-in hands free phone has the circuitry for the telephone's Calling Number Delivery (CND) signal receiver from which it will display the calling phone number and activate the associated functions. Voice signal processor with required memory for storing the voice messages of the multiple voice mail boxes. Keyboard interface for programming and controlling slave devices, and also it is used for making telephone call; and a cathode ray tube (CRT) or liquid crystal display (LCD) monitor is for viewing the picture taken through the video signal from the charge couple device (CCD) camera of the door phone (32). The operations and the functionality of the control base phone station (10) will be described later with detailed explanations for the corresponding flow diagrams.

DOOR PHONE:

The hardware block diagram of the door phone (32) is shown in figure-4. It may connect with video phone line

(18) and a maximum of ten door phones can be connected to the bus (18). The door phone units are recognised by its appropriate address, the addresses are set by BCD switch (106). The addresses can be set from numbers 10 to 19.

5 The operation of door phone (32) unit is described by flow diagram in figure-4A. If control unit (10) calls the door phone by its address, then it will switch on the infrared Charge Coupled Device (CCD) camera (101) for video, while the hands free phone circuit (100) is for

10 voice communication. If any visitors pressed the call button (107), the door phone unit (32) will activate to look for any signal being in transmission from other similar unit that holds the bus (18), by monitoring the on-hook bus voltage. If the bus is free for

15 communication, it may hold the bus (18) and send its own addressed signals, and then wait for the control unit to respond. The control unit will respond by sending door phone addressed signals to establish the communication as explained above. If control unit sends stop signal then

20 the camera (101) will be switched off and the bus (18) is free for other door phone units (32) to interrupt the controller. The address of door access control device is programmed by the user, and is being set with the programmable stack address number for the door phone

25 (32).

The first entry may correspond to the door-latching device address, the second entry may be used to program the voice prompt corresponding to the location of the

30 door, such as "Main Door", "Rear Door", etc. this will be

prompted to the user before establishing communication with door phone (32).

MONITOR PHONE

5

The video view of the camera can be monitored from either at the monitor phone (24) or at the base phone station (10). The hardware block diagram of monitor phone is shown in Figure 8 and corresponding flow diagram is shown in Figure 9.

Monitor phone (24) is connected to any one of the extension line (14) and it may ring for all calls at that extension. By pressing the talk button (113), user can answer to that call through hands free phone circuit (110). If the call is from door phone (32) then the CRT or the LCD monitor (111) is switched on to display the picture which was taken from the camera view of the door phone (32) and at the same time it enables the hands free phone circuit (110) for voice communication. If door release key (112) is pressed, the door release command signal is sent to the control base phone station (10). The control base phone station will select and operate the corresponding door access device as programmed for the door phone (32) in communication with this monitor phone (24).

The control base phone station (10) also displays the picture as captured from the camera view of the door phone (32) while answering for door call and operates

door access control on pressing door release key at the base station (10).

SECURITY DEVICES:

5

The hardware block diagram of security interface module is shown in Figure 10.

The security interface modules (34) are connected to the security signal line (20). The required power source for the module is taken from the signal line (20) while the communication to the control base phone station (10) is established through security signal lines (20). Each module has four sensor inputs (125) and from which each input terminals allow the sensor's circuit wiring connections for normally-closed (NC), common (C) and normal open (NO) contacts. Normally-closed with common contracts are used for serial link with one or more than one sensors having normally-closed contacts, and normally open with common contacts are used for parallel link with one or more than one sensors having normally open contacts.

Simultaneously both types of circuit wiring connections can be terminated to the same sensor input if state of either one condition changes. It means that either open circuit of normally-closed to common or short circuit of normally open to common are recognized as a valid input signal. If any NC contact is not in use, that circuit terminals must be shorted with C contact.

The logical set switch (124) is used to select inputs for double confirmation with at least two sensor inputs' signals within the time set by the time-setting switch (123). The minimum set time is five seconds and maximum set time is 80 minutes. The logical switch function can be explained with the example as follows: assuming all windows of one room are installed with normally-closed magnetic contacts at the centre of the room, a passive infrared movement detector is installed and pressure sensitive carpet is also used at the floor.

The magnetic contacts are serially linked to the terminals of sensor-1 input (125), while the passive infrared movement detector is installed and pressure sensitive carpet is also used at the floor. The magnetic contacts are serially linked to the terminals of sensor-1 input (125), while the passive infrared movement detector is connected to the terminals of sensor-2 input (125) and pressure sensitive carpet is connected to the terminals of sensor-3 input (125). Numbers 1, 2 and 3 of the logic setting switch (124) is set on for sensor-1, sensor-2 and sensor-3 respectively, and also the time is set to 30 minutes. If any intruder gets into that room through the window the normally-closed contact will initiate as a valid input signal for the open-circuit condition that will initiate the delay timer for thirty minutes. Within thirty minutes, if the intruder's movement is being detected by infrared movement detector, or the pressure of the intruder is sensed by the pressure sensitive carpet, then the sensor-2 or sensor-3 of the security

device may confirm the breach of security to the control base phone station (10). This double confirmation will eliminate the false warning as magnetic contact at the window may cause false warning if heavy wind from outside the window or infrared movement detector may cause false signal, when the movement of pet animal or moving curtains are detected. This way of confirming the security breach with other sensor input signals may not reduce the reliability of the security system, because out of three inputs either two inputs are sufficient to confirm the security breach condition.

If the intruder could fool the security system by causing the magnetic contact at the window, then his movement may be detected by the infrared movement detector, and it may be confirmed by the pressure sensor within the preset time. Therefore, it is flexible and versatile, when the security protection can be set for more than one confirmations from the different input signals after the first input had triggered signal at the security device.

On breach of security the control base phone station may go through a default sequence and any programmed sequence from the group execution service for executing the corresponding programmed group. The security devices are recognized by its registered stack address. The memory stack addresses are allotted with numbering from 21 to 99 for security devices. It can only be registered with the number as selected from this stack address, and

it can refer to the map for allocation of stack address.

The procedure for the security device registration is as follows: the security device can be registered under the slave registration mode which is set at the base phone station, and by pressing the registration switch (122) at the security device and then immediately followed with keying its appropriate stack address number from any extension phone (26), for the conformation and the response of registration is prompted to that extension phone (26). The security device is thus registered with that stack address number. The functional flow diagram of security device is shown in Figures 11A and 11B. The power supply to the accessory devices (36) such as infrared detector, glass breaks detector, may be provided from security interface module (34), when it is set arm state.

RELAY SWITCH

The hardware block diagram of relay switch (60) is shown in Figure 12.

The relay switch unit (60) is connected to network signal lines (28,30). The required power and communication to the control base phone station are operated through the network signal lines (28,30). Each relay switch (60) comprises of maximum four sets of non-voltage potential terminal connections for normally-closed (NC), common (C) and normally open (NO) contacts.

On a relay set command signal, the state of these contacts may reverse.

The general application of this device (60) is for remote switching of an appliance that needs to isolate the power supply. It can be used for isolating the power supply to a three-phase motor or appliances having different power supply voltage other than the normal power supply voltage of 110V/60Hz or 230V/50Hz, such as the electric door latch or the siren which are operating on 12V dc.

The functionality flow diagram is shown in Figure 13.

15

The registration procedure for this device (60) is also similar to the security device (34) as explained in previous paragraph, except that the allocated stack address numbers commence from 101 to 350, both the numbering limits are inclusive. After the device had registered with one stack address number, all the signal commands to that device will refer and recognize that particular number.

25 POWER SWITCH

The hardware block diagram of power control switch (48) is shown in Figure 14.

30 This device (48) is also connected to network signal

lines (28,30). The required power for its operation and communication with control base phone station will be operating through the network signal line (28,30). Power control is associated with the power point (52) of which it has a built-in manual switch (139). The appliance is plugged to the power point with the plug-top (52), and it can be remotely controlled, provided that the manual power switch (139) must switch to on. This procedure is created for safety reasons, so that the user must know his remote switching control on a known power point with the attached appliance. This sequence of action is necessary to limit and avoid accidental operation with respect to remote control for switching on an unknown electrical appliance.

The functional flow diagram of power control switch (48) is shown in Figure 15. The power point (52) that is already in remotely switched to off condition, may be manually switched to on by changing the manual switch (139) position twice. It means that the manual switch of that power point is flapped off-on, in order to reset the remote operation to manual operation. The off position of the manual switch ensures no power at power outlet of the power point (52). The device is recognised by its registered address, and all the signal commands to the device is referred with its registered address. The address registration can be done while the control base phone unit is set to slave registration mode, by changing the manual switch (139) position twice and followed with its appropriate address number through keying it at any

telephone extension (26), the registration is conformed,
and it can be confirmed by the reply of synthesized voice
from the phone. The valid registration address for this
device (48) is taken from the allocated stack address
5 numbers from 101 to 350, both the limits are inclusive.

LIGHT SWITCH:

The hardware block diagram of light control switch
10 (54) is shown in Figure 16.

The name of the device does not limit the device
(54) usage for light only, it can be used for other usage
such as switching any appliance operating with the
15 conventional power (110V/60Hz or 220V/50Hz). The
required power for the device (54) and the communication,
which are connected to control base phone station are
operated through the network signal lines (28,30). The
two way manual switch (56) gives complete facility for
20 over-riding of the two way relay (140) which is built in
the device, so that the appliances (58) can be controlled
at any time by either manually or remotely operation.
The status of the appliance is read through opto-isolator
so that the device (54) always give the actual state of
25 appliance (58) is controlled by either manually or
remotely operation.

The functional flow diagram is shown in Figure 17.
The address registration sequence is very similar to
30 power control switch (48). By setting the system at

slave registration mode, then flap the manual switch (56) to on-off or off-on, and then followed with the keying of the appropriate address number from any telephone extension (26), it thus registers the device (54) at the given stack address number. The valid number for this device (38) is also selected from the allocated stack addresses ranging from 101 to 350, both the limits are inclusive.

10 LIGHT DIMMER

The hardware block diagram of light dimming device (38) is shown in Figure 18. This device is used to vary the intensity of light.

15

The intensity is varied by varying the AC power cycle to the light (40). The "UP" key (142) when pressed will increase the duty cycle by 10% and "DOWN" key (143) will decrease duty cycle by 10%. If the device (38) is controlled remotely, then the key "0" at telephone keypad will switch off the light (40). Key "1" will set 20% power duty cycle, and it is increased in step of 10% power duty cycle per increment of the keying number, up to 100% at key "9". The functional flow diagram is shown in figure-10A. The registration sequence of the device (38) is by pressing both "UP" (142) and "DOWN" (143) keys simultaneously for a moment and then followed with the keying of its appropriate address number from any telephone extension (26). Thus it registers the device when the control base phone station (10) is in the slave

registration mode. The valid stack address number for this device (38) is similarly selected from the allotted numbers, ranging 101 to 350, both the limits are inclusive.

5

FAN SPEED REGULATOR:

The hardware block diagram and functional flow diagram of FAN control device (70) are shown at Figures 10 20 and 21 respectively.

The functions and operations are similar to the light dimming circuit (38), except that this device is suitable for varying the power cycle of inductive loads 15 such as FAN or motor. By varying the power cycle of the motor with the remote control phone, it may vary the speed of the motor.

AIR-CONDITIONER CONTROLLER:

20

The hardware block diagram of air-conditioner control module (44) is shown in Figure 22.

This module is interfaced with the built-in control 25 board of air-conditioner (46). This device (44) taps the signal from built-in sensor of air-conditioner (46) such as receiver or infrared hand held remote controller and it simulates similar signal to the control board, while in remote operation from control base phone station. The 30 required power may be taken from air-conditioner (46)

control board. The network signal line is operative for communication with the control base phone station.

The functional flow diagram of the air-conditioner control module (44) is shown in Figure 23. The device address can be registered when the control base phone station (10) is set to slave registration mode. By changing the state of air-conditioner (46) from the hand held controller that is associated with the air-conditioner (46) and followed with the appropriate address number which is key-in from any telephone extension (26), it will register the device with the specified address in the memory stack of control base phone station (10).

15

The remote operations of the above devices has the result that the operations of the devices from either internal telephone extensions or from external telephone, after conforming the right user by a valid pass-code. All the signal commands to the above device and responses of the device are referred with its registered stack address.

The functions implemented in control base phone station will be described now in more detail with supporting functional flow charts.

The functional block diagram is shown in figure 3. There are three major functional blocks such as Administrator, PABX and VMS. The administrator function

is to get status information from the above mentioned slave devices while the PABX and VMS exchange information from one another. It sends the required signal control instructions to all slave devices, PABX and VMS. So it
 5 may be easily explained, after knowing the functions implemented in PABX system and VMS system.

PABX:

10 The Private Automatic Branch Exchange (PABX) system has those important functions, which are shown in figure-13 for the PABX Supervisory System. All incoming calls from public telephone networks, through Central Office (CO) trunk line will get CO-Trunk Service as shown in
 15 figure 14A and 14B. If any extension telephone is "off-hook" it may receive Extension Phone Service and if FAX line is "off-hook" the outgoing FAX Service may be executed. The outgoing fax service is shown in figure-39.

20

In CO-Trunk Service, the central office trunk line may be monitored for Calling Number Delivery (CND), FAX tone, Dual Tone Multiple Frequency (DTMF) and busy tone signals. If CND signal is available that signal will be
 25 stored in the memory chip for further reference and displayed it at LCD panel or control base phone station (10), if FAX signal is detected that call will be transferred to FAX line, and the incoming FAX Service is initiated. If incoming call had specified any extension
 30 number, the DTMF signal will be transferred the call to

that extension and that call may receive Personal Call Service.

5 If the incoming call interested to operate any administrative function or VMS function, the signal command may be permitted after verifying the valid pass-code. All telephone extensions may ring for non-specified incoming calls, and if any extension that is already in conversation, it may receive the background
10 ringing. If nobody is able to attend the call, then this call may be attended by General Mail, if busy tone was detected any time from any CO-line, that CO-line may be "on-hook".

15 The Personal Call Service will be given to any incoming external call that request for any particular extension number or that it is transferred to any particular extension. If the extension is idle it may ring, while it is ringing, other extension can pick up
20 this call by dialling this extension number twice. If Personal Mail is active for that extension, that mail may attend to the call. If the particular extension is in conference or operating any VMS or Administrative Service, or defective, a voice prompt (busy prompt) may
25 advise to dial other extension number.

The "External" Call Service provides that the service has given the call connection after it had established connection with one CO-line and one extension telephone.
30 By flapping the hook of the extension phone, it will hold

the existing external telephone connection and allow the extension phone to establish and connect the call, or it may pick up next incoming call, or the extension may be used to operate VMS or administrative operation, or
5 calling some other extension and that may transfer the on-hold call, or calling external telephone number and enabling for three party conference.

The received CND signal may be used in Caller Phone
10 Service. In Caller Phone Service, the selective incoming call may be recognized from its CND and that call may be answered by a special message stored in the Caller Mail, as assigned for that type of particular call. The selective incoming call may be transferred to some other
15 pre-programmed external telephone number for the External Call Transfer Service, or selective call may be informed to a pager as shown in Call Paging Service.

The General Mail Service will answer with pre-
20 recorded outgoing message for unattended incoming call, after the time out of received call or may be immediate if the program was activated by the user earlier. The General Mail outgoing message can advise the incoming call to make personal call with the extension phone
25 number, and the caller may receive any available message that may be recorded in the personal mail of that extension phone. If the caller wants to convey any message to that extension it may be recorded at that personal mail. If the incoming call did not specify any
30 extension number, he may record his message at General

Mail, after the "beep" sound.

An independent Personal Mail is assigned for every extension telephone, except for extension-0 which is built-in hands free phone at control base station (10). If any extension telephone user activates Personal Mail for his extension, then all incoming call to that extension, either from extension or from General Mail may receive Personal Mail Service. The Personal Mail Service may deliver a pre-recorded outgoing message to the caller. If any answer was available to him, his messages may be recorded in the Personal Mail assigned for that extension. The messages received at the Personal Mail can be retrieved either at that particular extension or from remote external telephone after keying the valid pass-code as assigned for that Personal Mail.

The Extension Phone Service is given for all extension telephones. Extension telephones may operate home administrative instructions or VMS instructions. It may make call to other extension, or it may make external call, and it may pick up the call ringing at other extension. The recipient can transfer the received call to other extension, and he can allow or put the call into conference with either two external phones or one external party and one internal extension.

The Home Administrative Service may pass all valid instructions or signal commands to PABX interface or to

Administrative Service. The response, which is received from administrative system, may be played as voice message prompt. The administrative signal commands may activate or deactivate General Mail, Personal Mail, 5 Caller Mail and Screen Mail, and the administrative signal commands may switch "on or off" the devices such as door phone (32), light control switch (54), power control switch (28), relay switch (60), and also control the devices namely fan speed regulator (70), light 10 intensity dimmer (38) and air-conditioner controller (44); and as well as arm or disarm security devices (34) and arm or disarm programmed executable instruction-groups.

15 The VMS Supervisory Service provides the functions, which are required for access into VMS. The implemented functions are "Record" and "Play" Personal Mail outgoing messages; "Play current message", "Play next message", "Play previous message", "Delete current message" and 20 "status" of received messages from Personal Voice Mail. The above mentioned functions are implemented for General Mail and also Caller Mail which has implemented for a maximum of ten Callers Mails. The Personal Mails means the voice message mail associated or devoted for the 25 extension at which it is given with the appropriated access command.

30 The built-in phon at the control base unit (10) which is assigned as extension-0 is not allocated with the personal voice mail. If Personal Mail access

commands are given to the control base phone station (10), then that commands may be considered for General Mail access commands. In addition to this, the VMS Supervisory Service provides access to "Record" and "Play" standard voice prompts and "Delete" current voice prompt. The prompt-0 is used as "welcome" voice prompt at the time of receiving incoming calls, the prompt-1 may be used to advise the incoming call that "the requested extension is busy and may try for some other extension", the prompt-2 is used for the visitor at the door, prompt-3 to prompt-9 user can record his own messages and program them to executable instruction groups: such that the voice prompt may deliver at appropriate time.

For example the pre-recorded messages may be delivered after calling police station at the time of security breach or deliver the appropriated messages to the fire station when the fire alarm was triggered. The voice prompt message delivery does not limit to police and fire station and it can be programmed to deliver other voice messages as per the needs and requirements from the users.

BASE PHONE:

25

The built-in phone at control base station (10) can act as normal phone with the assigned extension number "0". All the features given for other extension phones are implemented for this base phone, except a devoted Personal Mail was not assigned to this phone. In

addition to this it has few special functions, such as CND display, repetitive call of 30 stored telephone numbers, and repetitive dial.

5 The repetitive dial function can be explained as follows: by pressing the redial switch, it will dial the last dial number and if that number is busy it will be dialled again and again until the call is successfully connected with the recipient; or by pressing the redial
10 switch again to stop the repetitive dial. The repetitive call is similar to the repetitive dial except that the dialled number may be selected from one of thirty stored telephone numbers from the telephone memory directory of the control base phone station.

15

ADMINISTRATIVE SERVICE:

 The Administrative Service exchanges the information from PABX, RS-232, all slave devices, security devices,
20 door phones, VMS, keyboard and instruction groups. Each task is executed as a signal individual task. If any information or service is being required from other task, it will be provided by the Administrative Service as and when it is requested.

25

 The RS-232 Service is provided for upgrading the system from external computers or custom-built mimic
 equipment interface, or for future expansion. The external equipment can log in with this system after
30 entering a valid pass-code. Once any device successfully

log in after that any request from the equipment with valid format may be serviced and any change in the events also it will be informed to the equipment for data logging and mimic the slave device status. Change in
5 equipment or disconnection of the equipment is recognized from the token number issued to the equipment at the time of log in, and this token number is polled very often. So that each time any equipment interfaced or changed in the interfaced equipment with this system it is supposed
10 to give a valid pass-code. This feature may discourage the unauthorized operation of the system, from external computer.

The PABX Interface Service may receive
15 Administrative and VMS commands from extension telephones (26), keyboard of control base phone unit (10) and remote external telephones. These commands may be serviced by the signal command execution service as shown in figure-50. The signal commands will be passed to the respective
20 slave devices. The group programs, arm or disarm commands may set corresponding status in memory stacks such that while polling that group for execution, the instruction programmed in that group may start to execute or stop from further execution. The response of the
25 given signal command is played from VMS system. The doorphone commands may operate corresponding door phone and door access control devices. The VMS commands are passed to the VMS interface service. The VMS administrative commands may operate the corresponding
30 voice mail messages or voice prompts.

Slave Communication Service may scan the status of all slave devices connected to the system through security signal line (20), and both network signal lines (28,30). The latest status of the devices may update the
 5 corresponding status in the memory stack and at which the device is registered. The slave devices are registered in allocated memory stack with its factory-set's unique identity number, which is shown as "MY-ADDRESS" in the flow diagrams. If any command or instruction to any
 10 slave unit may be carried from this service and the latest status may update the old status. The change in previous and latest status may set the corresponding event register, so that the status of the event may be given to the external computer or mimic panel through RS-
 15 232 port on proper request from that external instruments.

The security and door call service may inform the user with default voice prompt at the time of visitor
 20 activating the door phone (32) or activation of armed security devices. If door prompt in active that may be delivered to the door at the time of visitor activating the door phone (32), and if any voice is received that may be recorded at the General Mail. If door open
 25 command issued that may initiate door open sequence, to activate relay device programmed as door open device in corresponding door phone stack, within the delay
 programmed in stack 20.

30 The VMS Interface Service receives record and play

commands from PABX system and administrative system. The VMS administrative commands such as enable or disable General Mail, Personal Mails, Caller Mail and Screen Mail. The active state of the above mentioned mails that
5 are stored as status register for individual mail system, and it may be compared before any play or record operation to the corresponding mail system. The user's recordable voice prompts, which are assigned with the prompt number from 0 to 9, are stored in the volatile
10 Random Access Memory (RAM), the message may lose when the battery had lost its power. These voice messages may require recording all over again when there is lost in power from the flat-battery.

15 The factory programmed voice prompts, as stored in the non-volatile Read Only Memory (ROM) chip under the prompt number 10 to 99, are used as identity prompt for the location and kind of device while reporting status of any doorphone, slave device and security device.

20

The Prompt Maintenance Service shows the play, record and delete sequence for voice prompts. The sequences for play, record, and delete message, of any mail is shown in Message Maintenance Service of figure-
25 56. If Screen Mail Service is activated for any mail system, the received messages may be delivered immediately to the user, if it is not delivered it may be retained in the mail.

30

The keyboard and display interface service allows

maintenance of the sequence of functions or operations, which are assigned for any key to be used in administrative operations. By pressing such a key, it may initiate for its assigned function. The pin key that
5 is located at the rear side of the unit (10), may initiate Code Edit service. The Code Edit Service may display and allow the user to edit old code numbers after entering a pin-number, which is unique for the control station (10). The code number-1 to code number-8 are
10 assigned for extension-1 to extension-8 respectively. The user of that extension can use the corresponding code for remote access to the system. All eight codes are permitted to use all the operative instructions from remote external telephone, except that the Personal Mail
15 assigned for other codes or other extensions cannot be accessed.

The slave devices are registered in its allocated stack, and the address of the stack may be used to
20 represent the device. The security devices (34) are registered from stack address-21 to address-99, other slave devices such as Light control switch (54), Power control switch (48), Relay switch (60), Air-conditioner controller (44), FAN speed regulator (70) and Light
25 dimmer (38) are registered from stack address-101 to address-350. Slave registration is initiated by Register key followed by one of the eight pass codes, which is discussed in the previous paragraph.

30 The slave registration sequences for each slave

device are described while explaining the device in earlier sections of this chapter. The slave devices have its own identity number that may be registered in its allocated memory stack. The registered slave can be
 5 deleted from the memory stack, by pressing "Delete" key followed by "Device" key and the address of the stack, while the control station (10) in slave registration mode.

10 A group of instructions can be programmed in one stack, such that these instructions may be executed in sequential manner. If any condition instruction is found in the sequence, the additional instructions may be
 15 executed after the true state of that condition of instruction. These groups are programmed in stacks-400 to 560. Only the "armed" groups are executed, so that the user can program different set of application in different group. When it needs to be executed, the appropriate group can be armed for action from either
 20 issuing commands or programming in other groups as operative instruction. Door phone ON-command may be followed by voice prompt to deliver voice message at door phone and door phone may be switched off after delivering the voice message. On phone call, the operative
 25 instruction for the specified phone may be called and delivered the programmed voice prompt or the voice prompt. The customer's specific applications are possible to implement, by programming the sequence of actions in these groups.

The group programming sequence is explained with an example. In this example the user wants to call the police on breach of security at his house. Assuming there are five security zones in his house the security devices are registered in stack-21, 22, 23, 24 and 25. The necessary security sensors (36) are interfaced to the security device (34), and the wiring for security signal line (20), network signal line (28,30), telephone extension line (14) and co-trunk line (12) are properly installed. The telephone directory entry-0 is programmed for auto-dial to the police phone number. The voice prompt-3 is recorded for voice messages with the police and if he programs the stack-400 and 401 as shown in Table-1 and Table-2 respectively. When the user wants to leave the house, he can arm the group-400 by giving the commands as "#400#1" through any extension phone or his mobile hand phone with the valid pass-code. When the group-400 is in arm state it may be executed at group execution service and it will arm the security devices- 21, 22, 23, 24 and 25, and also the group-401. The condition instruction in the group-401 may monitor the status of security devices for its activation.

On breach of security at any zone may set the group-401 as "Condition Active State", and operation instruction of group-401 may start to execute. The telephone call service shown in figure-64 may call the police and deliver the pre-recorded voice prompt from prompt entry-3.

	Entry Number	Description	Address	Command	Remarks
	01	Device	021	#1	Arm security device
5	02	Device	022	#1	Arm security device
	03	Device	023	#1	Arm security device
	04	Device	024	#1	Arm security device
	05	Device	025	#1	Arm security device
10	06	Group	401	#1	Arm Group 401

Table-1 Group-400 entries

	Entry Number	Description	Address	Command	Remarks
15	01	Device	021		Condition Instruction
	02	Device	022		Condition Instruction
	03	Device	023		Condition Instruction
	04	Device	024		Condition Instruction
20	05	Device	025		Condition Instruction

15	Entry Number	Description	Address	Command	Remarks
	06	Phone	00		Phone directory entry
	07	*8	03		Voice Prompt Entry

Table-2, Group-401 entries.

5

If the user wants to switch on the lights in each zone as and when the zone comes in to the security breach state, then he may program the group-402 as shown in Table-3, and programming the group-400 to arm the group-

10 402. Assuming the devices-101, 102, 103, 104 and 105 are the corresponding lights of the zones having security device-21, 22, 23, 24 and 25. The condition instructions of group-402 may monitor the status of security devices, and the activation of one security device may activate

15 the immediate following devices as programmed for operative instructions, such that activation of security device-21 may activate the lighting device-101, and similarly activation of security devices 22, 23, 24, and 25 may activate lighting devices 101, 102, 103, 104 and

20 105 respectively.

	Entry Number	Description	Address	Command	Remarks
	01	Device	021		Condition instruction
25	02	Device	101	#1	Switch-on instruction

	Entry Number	Description	Address	Command	Remarks
	03	Device	022		Switch-on instruction
	04	Device	102	#1	Switch-on instruction
5	05	Device	023		Switch-on instruction
	06	Device	103	#1	Switch-on instruction
	07	Device	024		Switch-on
	08	Device	104	#1	Switch-on Condition
10	09	Device	025		instruction
	10	Device	105	#1	Switch-on

Table-3, group-402 entries.

15 On breach of security the condition instruction may
 set the group as "Condition Active state", and
 immediately followed with the operative instructions for
 executions, so that the light associated with security
 zone may be switched on. After execution of operative
 20 instruction the group may reset from "Condition Active
 State" so that the group may start to monitor for the
 other security devices on execution of the next condition
 instruction onwards.

25 While executing any group, all the instructions
 programmed in that group are monitored, so that it is
 satisfying to any one of the programmed condition may

start to execute the next following operative instruction.

Figure 24 shows the general configuration for all the features and functions and devices as described above.

The security system has allow the flexible facility for the zones to be localised for convenience in trouble shooting. The zoning facility needs not be fixed in the base unit. The zone facility is in the localised device, which can be installed near the group of sensors or detectors. The localised zones are distributed in the security signal line, as bus architectural connections. This facility is different from any existing system.

The two branch signal line ports for the generic wiring are design for a maximum of 200 slave devices connections. It allows for connection of 100 devices per signal line in bus architecture. It is sufficient to meet the large demand for input/output joints. It is versatile for expansion and allows flexibility for convenience in wiring extension.

With reference to Figure 25 there is shown the locations for the items of the system of Figure 3 in a floor plan layout. The items are to be wired accordingly to the single line diagram as shown in Figure 24.

CLAIMS:

1. A domestic monitoring and control system comprising a control unit; switch means for controlling
5 a piece of electrical equipment, the switch means being controlled by the control unit; the control unit being connected to a communication link, and being operative to change a state of the switch means so as to modify the
10 operation of the equipment in response to a predetermined action signal received from the communication link and further operative, on receipt of a predetermined enquiry signal from the communication link, to apply to the communication link a response signal indicative of a state of the switch means.

15
2. A system according to claim 1, in which the switch means is operative to control more than one piece of electrical equipment and/or to control more than one function of a piece of electrical equipment, distinct
20 action, enquiry and response signals being associated with each appliance and/or function.

3. A system according to claim 1 or claim 2, in which the communication link is adapted for connection to
25 a private or public telephone line.

4. A system according to claim 3, in which the action and enquiry signals may comprise telephone dialling signals, such as DTMF signals.

5. A system according to any preceding claim, in which the response signal comprises a synthesised speech signal.

5 6. A system according to any preceding claim which further includes sensors which monitor the status of items not under its direct control.

7. A system according to claim 6 in which at least
10 on sensor operative to determine whether a door of the house is locked.

8. A system according to any preceding claim further comprising remotely operable locks for securing
15 and releasing, under the control of the system, an entry door to the house.

9. A system according to claim 8, in which each of such codes is operative to generate a feedback signal for
20 detection by the control unit in confirmation of the status of the door under its control.

10. A system according to any preceding claim further comprising telephone switching means connected to
25 one or more telephone instruments within the house and to an external line of the public switched telephone network, at least one local telephone instrument being a door entry phone, the system being programmable by a house owner such that on the entry phone being activated
30 by a caller to the house, a connection is made between

the entry phone and a pre-selected one or more internal telephone instruments and/or a predetermined number on the public switched telephone network is called.

5 11. A system according to claim 10 further comprising means for detecting a calling line identifier signal on a line connected to the public switched telephone network on receipt of a call from that line, storage means for storing a plurality of calling line
10 identifiers associated with callers to which the user wishes to send a predetermined message, the system being operative to release the message to the caller.

 12. A system according to claim 11 further
15 comprising storage means for the calling line identifiers of known callers and data identifying those callers, and means operative, when an incoming call is received, to search the storage means for a matching calling line identifier, and if a match is found, to display the
20 identifying information to a user so that the user is informed of the identity of the caller prior to answering the call.

 13. A domestic monitoring and control system
25 substantially as described herein with reference to Figures 3 to 25 of the accompanying drawings.



Application No: GB 9518624.3
Claims searched: 1-13

Examiner: Simon Rees
Date of search: 5 December 1995

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.N): H4K (KOF, KOC)
Int Cl (Ed.6): H04M (11/00, 11/02, 1/57)
Other: ONLINE: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X,P	GB2285365A	(COSMIC) Whole document, especially from line 21 of page 3 to line 7 of page 4, lines 1-8 of page 7	1-4, 8-10
X,P	GB2278463A	(BRITISH GAS) Whole document, especially pages 19/20 and figure 14.	1-5
X	GB2258118A	(DURRANT) Whole document, especially paragraph 3 of page 1.	1-4.
X	US4918615A	(SUZUKI) Whole document, especially summary, line 21 of column 4 to line 47 of column 5 and figures 4 & 10.	1-5, 8, 9
A	US4776005A	(PETRICCIONE) Whole document.	11, 12
X	US4748654A	(GRAY) Whole document, especially lines 48-58 of column 1.	1-5
X	WO89/11194A1	(CANADIAN COMMS) Line 25 of page 1 to line 24 of page 2, and line 13 of page 25 to line 2 of page 26.	1-6

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